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THE PHYSIOLOGY OF ANESTHESIA AS RELATED TO GENERAL SURGERY

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SINCE no one anesthetic agent will satisfy all of the criteria for the ideal anesthetic agent,¹² it is necessary for those of us who administer anesthetics to know the basic indications, contraindications, applications and limitations of the agents that we use. Unless we understand these physiologic fundamentals we cannot intelligently discharge our daily duties to the best interests of the patient.

This paper is intended to correlate the practical physiologic and pharmacologic actions of drugs and anesthetics used in surgery. A better understanding among all members of the surgical team will usually allow the anesthetic to be fitted to the patient rather than vice versa for anesthetic accidents more frequently result from ignorance and negligence rather than from mischance.

In considering the physiology of this subject, the main attention is directed to three major systems⁶ most directly implicated in anesthesia: the nervous system, the respiratory system, and the cardiovascular system.

The Nervous System. The primary function of the anesthetist is to relieve pain, whether it be by local, regional, spinal or general anesthetic means. The physiology of pain pathways, the local and reflex changes produced by painful stimuli and pain localization must be considered and handled to the best of our knowledge at this time.

Sleep is a normal state in many ways closely associated to uncon-

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sconsciousness attained by general anesthesia. One must remember that induced unconsciousness is an abnormal state bordering on death.

Muscular tone and relaxation are terms generally ill defined and at times have a different meaning to the surgeon and the anesthesiologist. According to Sherrington¹³ muscle tone is the steady reflex contraction which resides in the muscles concerned in maintaining the postural characteristic of a given animal species. When muscles are relaxed, the body collapses. Normally, however, stretch reflexes stimulate muscle spindles and a sustained reflex results in alternate flexor or extensor muscle groups. Relaxation may be defined as the lessening of tension or to loosen. Spinal anesthesia not only produces the ultimate in muscular relaxation but also usually deflates the gut. In contrast to this, patients under deep general anesthesia may have a very distended gut which the surgeon erroneously interprets as inadequate relaxation, although the abdominal wall is flaccid.

Though the fundamental basis of tonus in voluntary muscles is the myotatic reflex centered in the cord, the tonus state is affected profoundly by higher centers. Tonus is also influenced by many different types of stimuli from the skin, muscles, tendons, periosteum, peritoneum, mesentery, organs of sight, smell, and taste, walls of respiratory and digestive tracts, carotid and aortic sinuses and body, and other structures. These receptor organs may be stimulated electrically, chemically, thermally, or mechanically by stretching or pressure. According to McCann⁷ a distinct increasing gradient in intensity of tonus response to surgical trauma occurs, proceeding from the level of the pelvis and upward through the thoracic dermatomes. This gradient implies an increasing impediment to the operating surgeon through ascending dermatomes unless deeper planes of anesthesia balance the rising gradient of irritability. McCann also concluded that reflex tonus response to trauma is identical, whether it occurs in response to trauma in somatic fields (cerebrospinal nerves) or visceral fields (autonomic nerves).

Reflex response⁸ of the accessory abdominal muscles of respiration is of both tonic and superimposed rhythmic (phasic) type of contraction. The tonic type, a sustained true contraction (apparently a spinal reflex), is completely independent of and dissociated from the cyclic respiratory cycle controlled by the respiratory center. It produces a mild squeezing effect which somewhat reduces the cubic capacity of the peritoneal cavity, crowds the abdominal viscera toward the anterior abdominal wall and into the incision. Surgeons are acutely aware of their responsibility in producing pain impulses by surgical trauma in areas innervated by the somatic nervous sys-

tem but they are not as keenly aware of pain impulses activated by trauma to the viscera which likewise produces pain stimuli via the autonomic system which reflexly activates respiratory motor response and produces muscle spasticity.

The autonomic nervous system is important for many reasons. It governs the activities of the cardiovascular system, the caliber of the bronchi, the secretion of mucus and saliva, the body temperature, and produces many postoperative complications such as nausea, vomiting, distension and retension, and kidney secretion. This system is concerned with those processes which are normally beyond voluntary control and are for the most part beneath the realm of consciousness.

Anesthetic drugs that act as parasympathomimetic stimulants are sodium pentothal, cyclopropane, spinal, curare, and the opiates. These agents are capable of producing bronchoconstriction, laryngeal spasm, cardiac irregularities, asystole, slow pulse, drop in blood pressure, stimulation of the vomiting center, respiratory depression, and intestinal peristalsis.

Drugs that act as sympathomimetic stimulants are atropine, scopolamine, ether, benadryl, pyribenzamine, epinephrine, norepinephrine, and demerol. These agents are capable of producing bronchodilatation, an increase in pulse rate, an increase in blood pressure, respiratory stimulation, and intestinal ileus.

Of increasing interest to the anesthesiologist is the change of electrical potential of the brain under anesthesia. The brain cortex^{1,2} in the conscious state is electronegative (scalp electropositive) and in the unconscious anesthetized state becomes electropositive (scalp electrogenegative). Experimentally anesthesia can be induced by electrical means and in time this method may be more commonly used.

The Respiratory System. Respiratory problems are the most frequent and most troublesome ones that we deal with in clinical anesthesia. Our prime consideration, at all times, is to keep the patient well oxygenated. Failure to accomplish this results in hypoxia or anoxia with its graded effects upon the central nervous system, cardiovascular system and kidneys. There are many causes of anoxia, most of which are controllable and some that are not.

Respiration is probably controlled primarily by the carbon dioxide tension in the circulating blood. As the center in the medulla is very sensitive to slight blood variations in the blood carbon dioxide tension, an increase in carbon dioxide tension produces respiratory stimulation and a decrease in carbon dioxide tension produces respiratory depression.

All narcotics and most anesthetic agents render the cells of the respiratory center less able to respond to its usual stimulant, carbon dioxide. According to Dripps⁴ the greater the narcosis of the center the less responsive it is to its chemical stimulant. As narcosis deepens, there is a shift of the control of breathing from a central (medullary) or chemical type to a more resistant, primitive, reflex mechanism which maintains the activity of the center. This is accomplished by the stimulation of the chemoreceptor endings by anoxia in the carotid and aortic bodies which send impulses via the glossopharyngeal and vagus nerves to the respiratory center.

Surgeons generally prefer the anesthesiologist who presents them with a relaxed patient. Such relaxation may be attained at the expense of adequate respiratory exchange unless the respiratory exchange is supplemented. A patient with critically reduced tidal exchange may be just as effectively decerebrated as one who breathes no oxygen at all. Derrick⁵ has shown that an open chest reduces tidal exchange 50 per cent and unless these patients have supplementation to their own breathing the typical complications of anoxia may well ensue.

Ether is one of the few anesthetic agents that indirectly produces respiratory stimulation. Although it depresses the center directly, its ability to arouse stimulatory reflexes provides enough impetus for normal or greater than normal exchange. Oxygen requirements are increased in children, in patients having an increased temperature, and in the hypertensive, hyperthyroid type of patient.

The Cardiovascular System. Several important factors are listed that combine to maintain normal arterial blood pressure.

1. The cardiac pumping action.
2. The peripheral resistance is dependent upon the total cross sectional areas of the available exit vessels which are in turn modified by the following:
 - (a) Nervous system, vasomotor center and carotid sinus.
 - (b) Humoral effects on the vessels.
 - (c) The viscosity of the blood.
3. The quantity of blood in the arterial system.

Under anesthesia many reflexes, inhibitory and stimulatory, may alter the heart rate and rhythm, the blood pressure and pulse pressure. The medullary vasomotor center is most important in this regulating mechanism for it regulates the caliber of the large arteries, the arterioles, which constitute the most important part of peripheral resistance, and the entire venous system. The venous

system accounts for 70 per cent of the total volume of the vascular bed and here resides the greatest possibility of circulatory adjustment.¹⁰ Dilatation of the splanchnic vessels alone is capable of accommodating almost all of the blood in the body; in such an event the blood pressure would fall to zero. In early cases of shock the venous pressure falls before any alteration in arterial pressure is evident.

The most common cardiovascular change under anesthesia is hypotension. Hypertension and sudden cardiac arrest are of interest.

Hypotension may result from a number of factors but is usually due to a reflex loss of vascular tone. The stimulation of surgical manipulation and traction will produce, in many patients, almost immediate hypotension with instant reversal when the trauma is stopped. Spinal anesthesia, splanchnic blocks, or section of the nerves in the dermatome area so stimulated prevents this type of hypotension.

Although hypotension may be produced by blood loss, the most usual causes are reflex in nature and may require just as vigorous therapy.

Tovell¹⁴ has recently shown that arterenol, neosynephrine, vasoxyl and epinephrine administration produced a reduction in the total peripheral resistance of the vascular system. Ephedrine and cobefrin were exceptions. He believes, therefore, that one of the first group of these vasoconstrictor agents is indicated in hypotension, regardless of cause.

Intra-arterial transfusions may be indicated¹¹ in hypotensive states under the following circumstances:

1. Failure of intravenous transfusion to do the job as in acute hemorrhage.
2. Perfusion of the coronary arteries in hypotensive states.
3. Addison's syndrome.
4. Medical shock.
5. Circulatory collapse in acute dehydration.
6. Coarctation of the aorta.

One note of caution should be mentioned in the administration of blood in the radial artery. The artery should not be tied after use but its wall should be sutured to preserve its integrity. Gangrene of the hand may result, if the vessel is ligated, in patients having a congenital absence of the deep and superficial palmar arches.

Gillies⁵ and others have induced hypotensive states for surgical procedures in order to minimize hemorrhage and to lessen the

patient's anesthetic requirements. Although this procedure is gaining favor in England, others question the adequacy of cerebral, coronary and renal circulation in these induced hypotensive states.

Hypertension can also be a trying complication under surgical anesthesia. Hypoxia, a blood excess of carbon dioxide, a prolonged excitement stage, stimulation of the operative field, cyclopropane and epinephrine and/or nor-arterenol producing adrenal tumors are factors that may produce this complication. The causative stimulus, if known, should be removed. In an occasional patient, blood letting, the administration of dibenamine or inhalation of amyl nitrate may have to be instituted to bring the blood pressure to more normal levels. Unabated hypertension may initiate a cerebral hemorrhage. Pulmonary edema not uncommonly occurs in hypertensive episodes.

Sudden cardiac arrest may occur at any time during anesthesia. This catastrophe may or may not be preceded by obvious changes in the cardiac rate or rhythm. McQuiston³ believes that "cardiac arrest" is our modern terminology for an anoxic death which replaces our older term of thymic death.

Pure oxygen insufflations and temporary cessation of surgery will revert cardiac irregularities which may occur under anesthesia to a normal rhythm in most all cases without resorting to drug therapy.

Since it may be difficult to determine if cardiac rest has occurred, it is imperative that the chest be opened and cardiac massage instituted immediately. Admittedly some chests may be opened unnecessarily but an asystole of five minutes or more usually results in irreversible brain damage and death.

Epinephrine, although condemned by many, is still the most capable drug that we have to restart the heart. It should be given in a 1 to 10,000 dilution, the total dose not to exceed $\frac{1}{2}$ of 1 cc.⁴ Procaine one per cent should be administered into the right auricle with the epinephrine or preceding it.

In conclusion, a few of the basic pertinent physiologic and pharmacologic aspects of surgical anesthesia have been reviewed. Our emphasis should always be directed to continual proper oxygenation of the patient since anoxia is the fundamental basis of most anesthetic complications. A better understanding of these problems by all members of the surgical team will result in a safer sojourn for the patient.

REFERENCES

1. Burge, W. E., and Burge, E. L.: Effect of anesthetics on electrical potential of brain: further observations and demonstrations, *Anesth. & Analg.* 19:102 (March-April) 1940.

2. Courtin, R. E.: Electroencephalography during surgical anesthesia, Thesis, University of Minnesota Graduate School, 1949.
3. Derrick, W. S.: Personal communication to the author.
4. Dripps, R. D.: Basic Science Course at Walter Reed Hospital, 1951
5. Griffiths, H. W. C., and Gillies, J.: Thoraco-lumbar splanchnicectomy and sympathectomy, *Anaesthesia* 3:134 (Oct.) 1948.
6. Hoff, H. E.: Physiology in anesthesia, *Anesth. & Analg.* 28:296 (Sept.-Oct.) 1949.
7. McCann, J. C.: Reflex tonus response of respiratory muscle to trauma: pneumographic recordings during pentothal anesthesia, *Anesth. & Analg.* 28:241 (Sept.-Oct.) 1949.
8. McCann, J. C.: Splanchnic block in surgery of gallbladder and stomach, *Anesth. & Analg.* 30:181 (July-Aug.) 1951.
9. McQuiston, W. O.: Anesthesia for cardiac surgery (Refresher Course Program), American Society of Anesthesiologists, Nov. 1951.
10. Scurr, C. F.: Significance of blood pressure during anesthesia, *Anesth. & Analg.* 30:211 (July-Aug.) 1951.
11. Seeley, S. F.: Intra-arterial transfusion in profound shock, *Anesth. & Analg.* 30:195 (July-Aug.) 1951.
12. SeEVERS, M. H., and Waters, R. M.: Pharmacology of anesthetic cases, *Physiol. Rev.* 18:447 (July) 1938.
13. Sherrington, C. S.: quoted by Cobb, S., and Wolff, H. G.: Muscle tonus, *Arch. Neurol. & Psychiat.* 28:661 (Sept.) 1932.
14. Tovell, R. M.: New horizons for anesthesiologists, *Ann. Roy. Coll. Surgeons England* 9:383 (Dec.) 1951.

DUPLICATIONS STENOSIS and ATRESIA IN INFANCY*

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TWO of the more common congenital lesions of the intestinal tract in infants are duplications: stenosis and atresia. These lesions, particularly atresia, cause symptoms in the early post-natal period. For this reason, and because of the acute obstructive symptoms, treatment is similar and the general problem closely related.

Duplications. Duplications are congenital malformations of the intestinal tract which have been referred to in the literature as enterogenous cysts, giant diverticula and many others.² Although duplications may occur anywhere along the alimentary tract from the esophagus to the rectum, the commonest site for their occurrence is in the region of the ileocecal valve. They appear as cysts in the mesentery without continuity with the intestine (fig. 1), or as an outpouching or diverticulum opening into the bowel (fig. 2). The wall of duplications may exhibit all the intestinal layers. Cysts may, however, be subserous, submucosal, or intramural in location, and have a portion of the normal wall lacking.

Duplications manifest themselves at any age, even in late adult life. Commonly, however, they require treatment early in infancy. At this early age, particularly in the first two weeks of life, the symptoms are those of intestinal obstruction, characterized by vomiting, distention, and usually by green-watery stools. Later, tarry stools and stools containing red blood call the attention of the pediatrician to the presence of disease. Bleeding may reduce the circulating red cell volume and deplete hemoglobin to as low as 5 Gm. per 100 cc.

Enucleation of the cyst, if one is present, is difficult or may be impossible.³ The common wall existing between the duplications and the intestine makes it difficult to separate the two without injuring the bowel. Similarly the blood supply to the small intestine frequently courses over the surface of the cyst, and attempts to resect the cyst alone may cause necrosis of the bowel if the vessels are injured.

Resection of the intestine with lateral anastomosis is practical and safe. In five years at Children's Hospital in Denver, small intestine was resected on 23 occasions with one death. Three of

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the four duplications were resected successfully without mortality. If enucleation is impractical, primary resection of the intestine is the treatment of choice. More recently enterostomy with crushing

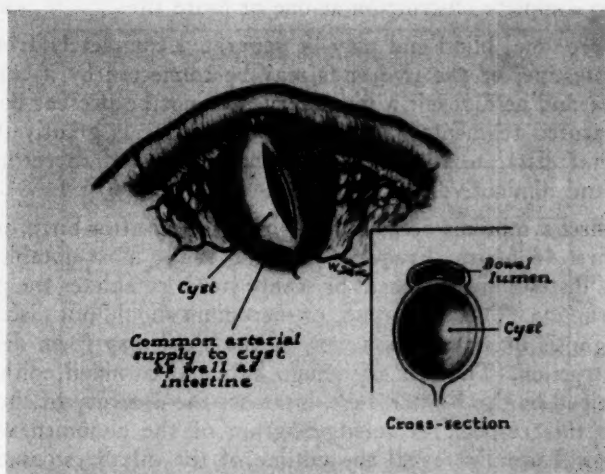


Fig. 1. Diagram showing the usual relation of the duplication cyst to the intestine. The common blood supply is illustrated.

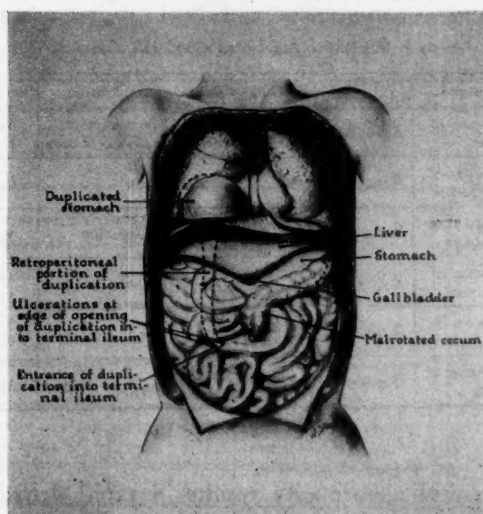


Fig. 2. A duplication arising in the terminal ileum and extending retroperitoneally into the thorax. Successfully removed in three stages.

of the spur and early (within five days) closure has been successful in the treatment of small bowel lesions in infancy.

Atresia and Stenosis. Atresia of the intestinal tract is characterized by complete obstruction. Two general groups exist: (1) atresia caused by a complete diaphragm and (2) narrowing of the lumen to complete obstruction at one or more sites.

The proximal blind end may be separated completely from the distal intestine, or the two ends may be connected by a cord-like structure and as a result a mesentery may not be present between the separated segments. The proximal intestine is greatly dilated while that distal to the atresia is functionless and therefore collapsed and diminutive.

The first symptoms occur almost immediately after birth, usually in the first 48 hours. Frequent vomiting is the most notable. Abdominal distention and absent or scanty stools completes the picture of obstruction. The appearance of meconium should not discourage the diagnosis of atresia, however, as the stool may form distal to the obstruction. The lack of lanugo hair and cornified epithelium, as identified by the Farber Test, increases the accuracy of the diagnosis in this respect. A roentgenogram of the abdomen without barium will usually reveal the outline of the dilated stomach and proximal intestine.

ATRESIA AND STENOSIS, INTESTINAL TRACT-12 CASES				
Results in Relation to Associated Conditions-Cases Surviving				
Lesion	Age on Admission	Prematurity	Associated Lesion	Corrected
1. Atresia of Ileum	2 days	No	Meckel's Diverticulum Incomplete rotation of colon	Yes No
2. Atresia of Duodenum	4 days	No	None	
3. Atresia of Jejunum	6 days	No	Stenosis of Jejunum	Yes
4. Atresia of Jejunum	2 days	No	None	
5. Atresia of Jejunum	4 days	No	None	
6. Stenosis of Ileum	9 days	No	Duplication of Intestinal Tract	Yes

Fig. 3.

This congenital abnormality results in rapid dehydration; the blood constituents are thrown into imbalance. The dilated proximal segment may perforate from the tremendous distention if the obstruction is not soon relieved. Surgical treatment must be instituted early, within the first week, or a fatal outcome is assured. Survival, however, has been reported up to nine months.

Multiple lesions may exist; other congenital abnormalities often occur, as in this series. A careful search of the entire intestinal tract is of less danger than the risk of overlooking additional abnormalities.

ATRESIA AND STENOSIS, INTESTINAL TRACT—12 CASES					
Results in Relation to Associated Conditions Cases Not Surviving					
Lesion	Age on Admission	Prematurity	Associated Lesion	Corrected?	
1. Atresia of Duodenum	14 days	Yes	Fibrocystic disease of Pancreas	No	
2. Atresia of Duodenum	5 days	Yes	Stenosis of small intestine multiple Obstructive Jaundice	No	No
3. Atresia of Duodenum	3 days	Yes			
4. Atresia of Jejunum (survived 74 days)	1 day	No	Congenital failure of attachment of the mesentery of the small intestine	No	
5. Stenosis of Rectum	4 days	No	Stenosis of colon at splenic flexure	No	
6. Atresia of Ileum	7 days	No	Incomplete rotation of mid gut Multiple Atresias	No	Yes

Fig. 4

In 1941, Ladd and Gross reported 52 cases with seven recoveries.² Donovan reported 9 cases with two recoveries.⁵ In 1947 Miller, however, reported 7 of 12 duodenal atresias surviving,⁴ and Potts had one death in 5 cases.⁶ The trend is definitely improving the prognosis.

ATRESIA AND STENOSIS, INTESTINAL TRACT—12 CASES				
Mortality in Relation to Operation				
Atresia of Duodenum	4	Duodenojejunostomy	3	2 (66%)
		No operation	1	1 (100%)
Atresia of Jejunum	4	Jejunojejunostomy	3	1 (33%)
		Duodenojejunostomy	1	0
Atresia of Ileum	2	Ileocolostomy with resection of Ileum	2	1 (50%)
Stenosis of colon and rectum	1	Colostomy	1	1 (100%)
Stenosis of Ileum with duplication of Intestine	1	Resection of Ileum with lateral anastomosis	1	0
Total	12		12	6 (50%)

Fig. 5

Children's Hospital Series. From 1945 to 1951, 12 cases of atresia and stenosis of the small bowel requiring treatment in the first 14 days of life were encountered. One of these died without

surgical therapy. Six of the 11 surgically treated infants survived.

Of the 6 surviving, there were no instances of prematurity. Three of four associated lesions of the intestinal tract were corrected (fig. 3).

Of the 6 fatal cases, there were three instances of prematurity (fig. 4.). There were seven additional lesions of the gastrointestinal tract, only one of which was corrected. Eight of the 12 cases had some associated congenital abnormality (figs. 3, 4). The average age on admission of those surviving was four to five days, while that of those not surviving was five to six days. In the group which did not survive, one child was admitted at the age of 14 days and died without operation. Otherwise, the two groups are about equal.

The Operation. Survival of an infant with an atresia or a stenosis with a small lumen $\frac{1}{8}$ inch or less is not possible. The operation of choice is an intestinal anastomosis around the lesion (fig. 5). The problem is less complex with a stenosis even though the lumen is small, for the distal segment is functioning and the anastomosis is technically easier. Preoperative enemas are of aid in increasing the lumen of the large bowel. Saline may be injected into the distal segment at the site of the anastomosis and gas may be withdrawn from the proximal segment facilitating anastomosis. One continuous fine catgut stitch reinforced with interrupted silk sutures is probably the best method of anastomosis. The bowel may be expected to function any time from the first to the fourteenth postoperative day.

SUMMARY

Duplications of the intestinal tract are sometimes bizarre and difficult to treat. Resection and side to side anastomosis is the treatment of choice in the young infant.

Prematurity and uncorrected associated lesions increase the hazards of intestinal atresia and stenosis. A full term infant with a simple atresia of the small intestine operated upon in the first five days has a better than 50-50 chance of surviving the necessary intestinal anastomosis. A search for multiple lesions should always be made.

REFERENCES

1. Barrington-Ward, L. E.: *The Abdominal Surgery of Children*, Oxford University Press, 1928.
2. Fisher, H. C.: Duplications of intestinal tract in infants, *Arch. Surg.* 61:957 (Nov.) 1950.

3. Ladd, W. E., and Gross, R. E.: *Abdominal Surgery of Infancy and Childhood*, Philadelphia, W. B. Saunders Company, 1941.
4. Miller, E. M.: Symposium on clinical advances in surgery; bowel obstruction in Newborn, *S. Clin. North America* 27:73 (Feb.) 1947.
5. O'Neill, J. F., and others: Congenital atresia of small intestine in newborn; report of 2 cases with review of successfully treated intrinsic obstructions of small bowel, *Am. J. Dis. Child.* 75:214 (Feb.) 1948.
6. Potts, W. J.: Congenital atresia of intestine and colon, *Surg., Gynec. & Obst.* 85:14 (July) 1947.

ACUTE SOLITARY DIVERTICULITIS OF THE CECUM

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ACUTE solitary diverticulitis of the cecum is rare. In 700 cases of surgical diverticulitis of the colon operated upon at the Mayo Clinic, 9 were said to involve the cecum only.¹ On careful study of the case reports, only 6 of these cases could be considered solitary diverticula. One of the reported cases was associated with a generalized colonic diverticulosis and 2 of the others were multiple diverticula involving the cecum. Since that report, Costin and Gaston² reported 2, Byrne³ *et al.* reported 5, and Collins⁷ reported 10 cases, bringing the total to 116.* This probably is not the true incidence of the disease as numerous single cases or small series have been treated without their having been reported. It is because of the scarcity of reference in the literature that our case is reported and the general subject discussed.

CASE REPORT

Mrs. S. Mc., a 57-year-old, white, widowed woman, was hospitalized on July 1, 1950, complaining of abdominal pain and right lower quadrant abdominal tenderness. Two days before admission her abdomen was considered by her to be distended and she had a generalized abdominal discomfort. Approximately 24 hours before admission she suddenly developed severe pain in the right lower abdomen. This was associated with no other gastrointestinal complaint and the review of systems was entirely negative.

Physical examination was essentially negative except for findings in the abdomen. In the right lower quadrant, tenderness but no rigidity was present. Pelvic examination revealed a firm, non-tender, movable mass in the right adnexal region which was thought to be an ovarian cyst.

Laboratory examination showed a red blood count of 4,500,000, a hemoglobin of 13 Gm., white blood count 8,450 and an essentially normal differential. The urinalysis was negative to chemical and microscopic studies. The feces were negative for blood and parasites.

On the day of admission she was operated upon with a preoperative diagnosis of acute appendicitis. At operation the appendix was grossly normal. An ovarian cyst of the right ovary was present. The anteriolateral aspect of the cecum was hyperemic and indurated. An appendix epiploic was similarly involved. Surrounding the edematous fat tab was a diffuse fibrous exudate. Immediately underlying the fatty mass, an outpouching from the cecal wall was present. This was involved in the inflammatory process described. The

*Since this article was prepared for publication, Lauridsen and Ross (Lauridsen, James, and Ross, F. P.: Acute diverticulitis of the cecum, *A.M.A. Arch. Surg.* 64:320-330, 1952) reviewed the world literature and reported 6 cases of their own, bringing the total reported cases to 155.

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fatty mass and diverticulum were removed by clamping across its base and amputating the structures distal to the clamp. The wall of the cecum was then closed, using two rows of interrupted mattress sutures of catgut. The closed cecal wall was then attached to the anterior abdominal wall using multiple interrupted sutures of catgut. The rest of the abdominal wall was closed. Thus had been created a potential cecostomy in case the sutured cecal wall opened. The anticipation of failure of the sutures in the cecal wall to hold was realized and a cecostomy developed. A massive wound infection occurred and required approximately two weeks to bring it under control. Grossly the specimen consisted of a fatty mass surrounding a nodule approximately 1 cm. in diameter. This was filled with firm fecal material. Microscopically, the specimen was made up of lining mucosa, a cavity filled with a fecalith surrounded by acute inflammatory cells and smooth muscle. Pathologically, this was typical of an acutely infected diverticulum. The right ovary was the seat of a dermoid cyst.

On July 13, 1950, an attempt was made to suture the defect in the cecum. This was again followed by wound infection and a disruption of the cecal suture line, and the patient was discharged from the hospital with a fecal fistula in the right lower quadrant. This persisted until her second admission on Oct. 4, 1950. At this time all evidence of abdominal wall infection had subsided and she had a typical cecostomy wound in the right lower quadrant plus an incisional hernia. On Oct. 6, she was operated upon and the cecostomy was closed. The drainage in the right lower quadrant ceased, and on October 18 the incisional hernia was repaired. She was discharged on October 30 with a well healed abdominal wall and with no complaints.

Roentgenologic studies of her colon following her last discharge from the hospital were negative for other evidence of colonic diverticula.

DISCUSSION

Diverticula of the cecum are of two general types, namely, true diverticula in which all of the elements of the cecal wall are found in the diverticulum¹⁴ and false diverticula in which only serosa and mucosa are found in the microscopic structure of its wall.^{9,21} Noon and Schenk¹⁷ analyzed 23 cases of cecal diverticula reported up to 1945 and found 12 true and 11 false type lesions. The general consensus is that diverticula in this region are, as in the remaining portion of the colon, false type lesions. Schnug¹⁹ does not agree with this. Diverticula may be congenital²¹ or acquired. Graves¹⁰ reported 2 cases in members of the same family and located in the same anatomic position. They were true diverticula and considered to be congenital. Waugh²² suggested that these lesions might be duplications of the appendix. He pointed out that some embryologists thought that an extra appendix did exist up until about six weeks of fetal life and that atrophy usually occurred at or about the seventh week. Theoretically, the microscopic structures should distinguish between an appendix and a diverticulum in that the appendix has a specific arrangement of lymphoid tissue and an inner circular and an outer

longitudinal muscle layer. When the surgically removed specimen is involved in acute inflammation, the microscopic structure may be so deranged that their original form can not be definitely made out.

The formation of acquired diverticula may be due to one of several factors:

1. An eversion of the cecal wall between two constricting anatomic bands.^{11,23}

2. Traction by adhesions.

3. Eversion of a weak spot in the cecum caused by migration of the purse string suture placed about the appendiceal stump at a previous appendectomy.

4. Eversion of a weakened area in the cecal wall resulting from rupture into the cecum of an abscess of the appendiceal stump.

5. Inherent weakness of the wall of the cecum due to congenital weakness; obesity; or atrophy of the fat along the vessels which penetrate the cecal wall.

6. Intracolonic pressure. Bunts³ discussed post-appendiceal right lower quadrant pain in which he found simple out-pouching of the cecal wall. The pain was relieved by surgical treatment of the post-appendectomy diverticulum.

In contrast to colonic diverticulitis, solitary cecal diverticula occur more frequently in women and 40 years is the average age of the reported cases instead of past middle-age. In generalized colonic diverticulosis, the incidence is higher in men and the age group affected is usually past middle-age.¹⁸

The preoperative diagnosis is usually, as in the case reported, acute appendicitis or some type of appendiceal complication unless the appendix has been previously removed. Ninety-four per cent of the previously reported patients were operated upon with a diagnosis of appendicitis or some complication thereof. The history, physical findings and routine laboratory work are usually consistent with a diagnosis of appendicitis.

The proper recognition of solitary cecal diverticulitis is usually made at the operating table. In 50 per cent of cases of cecal diverticulitis, a normal appendix and a cecal mass are found. The problem therefore resolved itself into the proper diagnosis of masses involving the cecum. Appendicitis is, of course, the most frequent pathology in the right lower quadrant. Carcinoma is the second most frequent lesion of the cecum requiring surgery. The differentiation between cancer and diverticulitis is facilitated if one keeps in mind the three types of malignant tumors involving the bowel at

this location. One type grows as a cauliflower-mass projecting into the lumen of the bowel and is slow to metastasize. A second type grows by direct extension through and along the various coats of the bowel and is less apt to show glandular metastasis. A third type ulcerates rapidly through the cecal wall and at operation usually shows many glandular metastases. The third most frequent lesion involving the cecum is tuberculosis. As a rule, in tuberculosis the ileum is also involved and small tubercles can be occasionally seen in the serosa of the bowel. The peritoneum is usually thickened, the lymphnodes enlarged and caseation and adhesions are usually present. Both ulcerative and hypertrophic forms of tuberculosis may involve the cecum. The fourth most frequent lesion which must be differentiated is actinomycosis. This usually starts in the cecum or in the appendix. The involved bowel walls are usually greatly thickened and in later stages multiple small abscesses are formed. Sinus tracts opening through the abdominal wall discharging characteristic sulphur granules may or may not be present. Another lesion from which diverticula must be distinguished is the nonspecific cecal granuloma. They are encountered in approximately the same frequency as diverticula and may be single or multiple. They are usually located on the medial aspect of the cecum above the ileocecal valve. This is a relatively rare place for ordinary diverticula as they are most frequently located on the anterior, lateral and posterior walls of the cecum and if they are located on the medial wall they are usually below the ileocecal valve²

The proper surgical treatment of cecal diverticulitis depends upon its proper recognition. There is no uniformity of opinion as to what can be expected from this lesion. It is stated by some^{4,13,10} that the most conservative type of treatment should be employed in that perforation, abscess formation, peritonitis, etc. are extremely rare complications of this condition. Others^{5,12} take the opposite view. It is agreed, however, that when definitive operative procedures are employed they should be as conservative as possible.^{1,15,16} A right hemicolectomy and surgical excision of the cecum has been done in approximately 33 per cent of the reported cases.¹ These operative procedures in patients who have not been previously prepared for surgery carry a relatively high mortality and should be avoided. Excision of the diverticulum with primary closure of the wall of the cecum is the operative procedure of choice. Lesions with a wide mouth and an associated obstructing fecalith should be treated by dislodging the fecalith and inverting the diverticulum into the cecum through a purse string suture as used in the disposition of an appendiceal stump. When a localized abscess is present, it should be drained and definitive surgery done at a later date.

In the case reported, because of the extensive induration and edema of the wall of the cecum, it was anticipated that a disruption of the cecal suture line might occur, and for that reason the cecum was exteriorized. Disruption did occur and instead of having an intraperitoneal open cecum it was fixed to the anterior abdominal wall and resulted only in rather extensive cellulitis in the surrounding abdominal wall and the development of the cecostomy. Whether or not this procedure prevented a mortality is conjectural. Shaw²⁰ is opposed to exteriorizing procedures. We believe that in this patient the exteriorization procedure was lifesaving.

SUMMARY

A case of acute solitary diverticulitis has been reported. The rarity of the disease has been pointed out and the differential diagnostic points between diverticulitis, carcinoma, tuberculosis, actinomycosis, and nonspecific cecal granuloma have been discussed. The treatment should be conservative. Conservative treatment is considered to consist of the dislodgement of obstructing fecaliths and the inversion of the diverticulum into the cecum. If inversion can not be done, diverticulectomy with primary closure of the cecum should be performed.

In lesions with extensive inflammatory involvement of the adjacent cecal wall, either a tube cecostomy or a cecal exteriorization procedure is the operation of choice. A primary right hemicolectomy or surgical excision of the cecum should not be done. If carcinoma cannot be ruled out, an ileotransverse colostomy should be done as in a two stage hemicolectomy. During the interval between operations, the patient can be adequately prepared for the major surgical procedure.

REFERENCES

1. Anderson, L.: Acute diverticulitis of cecum, *Surgery* 22:479 (Sept.) 1947.
2. Baker, J. W., and Carlile, R.: Solitary diverticulitis of cecum, *J.A.M.A.* 122:354 (June 5) 1943.
3. Bunts, F. E.: Traumatic diverticulum of cecum following appendectomy, *Surg., Gynec. & Obst.* 19:791 (Dec.) 1914.
4. Burgess, C. M.: Diverticulities of cecum, *Am. J. Surg.* 50:108 (Oct.) 1940.
5. Busch, I., and Friedfeld, L.: Solitary diverticulities of cecum, *Am. J. Surg.* 57:555 (Sept.) 1942.
6. Byrne, J. J., Kallan, A. C., and Bassett, A. A.: Acute diverticulitis of cecum, *J.A.M.A.* 144:823 (Nov. 4) 1950.
7. Collins, D. C.: Acute diverticulitis of cecum simulating carcinoma; report of ten cases, *Ann. West. Med. & Surg.* 4:294 (June) 1950.
8. Costin, M. E., and Gaston, E. A.: Solitary diverticulum of cecum, *Arch. Surg.* 60:743 (April) 1950.

9. Drummond, H.: Sacculi of large intestine with special reference to their relations to blood vessels of bowel wall, *Brit. J. Surg.* 4:407 (Jan.) 1917.
10. Graves, W. N.: Solitary diverticulitis of cecum, *Minnesota Med.* 21:615 (Sept.) 1938.
11. Greensfelder, L. A., and Hiller, R. I.: Cecal diverticulosis, with special reference to traumatic diverticula, *Surg., Gynec. & Obst.* 48:786 (June) 1929.
12. Jonas, A.: Solitary cecal diverticulitis, *J.A.M.A.* 115:194 (July 20) 1940.
13. Kirkman, N. F.: Solitary cecal diverticulitis, *Brit. J. Surg.* 37:365 (Jan.) 1950.
14. Leonardo, R. A.: Primary solitary diverticulitis of cecum, *Ann. Surg.* 91:540 (April) 1930.
15. McVay, J. R.: Diverticulum of cecum, *J. Missouri M.A.* 26:119 (March) 1929.
16. Miglizccio, A. F.: Acute diverticulitis of cecum, *Rhode Island M.J.* 32:255, 1949.
17. Noon, Z. B., and Schenk, H. L.: Solitary diverticulitis of cecum, *Am. J. Surg.* 68:364 (June) 1945.
18. Ochsner, H. C., and Bagen, J. A.: Diverticulosis of large intestine; evaluation of historical and personal observation, *Ann. Int. Med.* 9:282 (Sept.) 1935.
19. Schnug, E.: Acute diverticulitis of cecum, *Surgery* 13:282 (Feb.) 1943.
20. Shaw, R. E.: Acute diverticulitis of cecum and ascending colon, *Lancet* 1:114 (Jan. 21) 1950.
21. Telling, W. H. M.: Diverticula of intestine, *Brit. J. Surg.* 4:468 (Jan.) 1917.
22. Waugh, T. R.: Appendix, vermiformis duplex, *Arch. Surg.* 42:311 (Feb.) 1941.
23. Wilson, F. C.: Diverticulitis of cecum, *J.M.A. Alabama* 1:282 (Jan.) 1932.

AN EVALUATION OF THE MANAGEMENT OF POSTOPERATIVE ANORECTAL PAIN

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FOR MORE than 25 years surgeons have made numerous attempts to improve the control of pain postoperatively in anorectal conditions. For a better understanding of this problem let us first review the nerve supply to this area. The anal canal and pectinate area are supplied chiefly through nerves of the cerebrospinal system. The rectum is supplied through the sympathetic nervous system, the mucous membrane of this viscus being insensitive to pain. The sympathetic fibers derive their origin from the inferior mesenteric plexus through its subordinate, the superior hemorrhoidal plexus, which accompanies the superior hemorrhoidal vessels to the rectum. It also receives fibers from the two pelvic plexuses which follow the middle hemorrhoidal vessels. Visceral branches of the cerebrospinal system arise directly from the second, third and fourth sacral nerves, conveying motor and inhibitory impulses to the rectal musculature. The nerve fibers are distributed to the internal sphincter muscle, and as in the rest of the intestinal tract are arranged in two networks, Auerbach's plexus between the longitudinal and circular layers of the muscularis, and Meissner's plexus within the submucosa. The anal canal, up to and including the pectinate area, is extremely sensitive because of its rich cerebrospinal innervation, which takes place through the third and fourth sacral and internal pudic nerves. The inferior hemorrhoidal nerve, usually a branch of the pudic, accompanies the inferior hemorrhoidal vessel across the ischiorectal fossa, and supplies the external sphincter tissue, the mucocutaneous lining (squamous) of the anal canal and the perianal skin. The perineal skin is innervated largely by the cutaneous filaments of the perineal nerve. The integument over the ischiorectal fossa derives its nerve supply from the plexus formed by the offshoot from the lower sacral nerves. The external anal sphincter muscle with its three divisions, subcutaneous, superficial and profundus parts, receives its triple nerve supply from the third and fourth sacral nerves through: (a) the inferior hemorrhoidal branch of the internal pudic nerve, (b) the deep perineal branch of the internal pudic nerve, and (c) the perineal branch of the fourth sacral nerve. All these branches possess both sensory and motor fibers and with them are distributed sympathetic nerve filaments. It is obvious that with such an abundant

nerve supply the problem of control of pain postoperatively is difficult.

The purpose of this paper is to cover only the most common anorectal surgical conditions. The discussion will be limited primarily to the use of local anesthesia and analgesia, both by topical application and injectable drugs. It is generally accepted that the improvement of surgical technic, the lessening of trauma and reduction of postoperative edema have definitely minimized the discomfort. Johnson and Schilla presented a comprehensive review of statistics, in which they state that technics in anorectal surgery have been more or less standardized, but preoperative and postoperative procedures vary greatly. By hypodermics postoperative pain control was accomplished, using morphine in 53 per cent of their series, Demerol in 22 per cent, Pantopon in 14 per cent and Dilaudid in 7 per cent. In using oral drugs, codeine and aspirin were the choice of 62 per cent.

Of the topical anesthetic ointments the more popular were Diothane 14 per cent, Nupercainal 8 per cent, Surfacaine 7 per cent, Benzodex 3 per cent, Pontocaine 2 per cent and others, 8 per cent. The use of hot compresses, enemas, cathartics, antibiotics, digital examination and diet are all adjuncts used partially or wholly in varying methods by the individual operator. They also found that of the types of anesthesia preferred for operation, spinal was the most often used, followed by general, caudal and local infiltration.

An ideal analgesic or anesthetic agent would be one which would produce immediate anesthesia with a prolonged effect, non-toxic, and with ease of administration. Toward this end the multitude of ointments, creams, oils, suppositories, aqueous and oil soluble injections have been devised.

Let us review, as Scarborough has, a number of the more commonly used drugs. Quinine hydrochloride and urethane has been found to be a less painful and less irritating solution than quinine and urea hydrochloride.

Eucupin, a quinoline derivative, was advocated by de Takats in 1926 for its prolonged action and gradual cessation of analgesia. Manheim and Marks in 1938 reported reliable anesthetic action for minor anorectal surgical procedures with Eucupin Dihydrochloride producing postoperative analgesia of three to seven days. Eucupin in distilled water has been used to relieve postoperative pain by topical application.

Nupercaine Hydrochloride, or percaïne, is considered by some to be more toxic than cocaine and 10 times more potent. Bacon

reports results superior to Novocain: painless injection, prompt anesthesia lasting six to six and one-half hours, no local irritation and no untoward effects. However, it is interesting to note that in reply to a personal communication he states that he has abandoned all drugs locally.

Diothane, a derivative of phenylurethane, was suggested by Rider for prolonged anesthesia in 1930. This observer concludes that when used subcutaneously it approximates procaine in toxicity. Rosser is of the opinion that 0.5 of 1.0 per cent Diothane in isotonic solution produces relatively little irritation and gives anesthesia lasting from several hours to several days. Since it produces immediate discomfort upon injection, he suggests combination with procaine for infiltration anesthesia. Other favorable reports on the use of Diothane have been made by Terrell, Simmons, Hertzler and Smith. Tutocaine Hydrochloride is considered to be twice as potent as procaine hydrochloride and one half as toxic.

Numerous anesthetic agents are now in use in combination with sweet almond oil, peanut oil or sesame oil for prolonged anesthetic effects. This action depends primarily on the slow rate of absorption of the injected material. In contrast to the water soluble anesthetic agents of prolonged action with analgesia lasting from several hours to several days, the effect of these preparations in oil is supposed to last from several days to several weeks. Originally devised for use in treatment of fissure in ano and pruritis ani, their use has been extended by some to control of postoperative pain. These solutions produce variable irritative reactions and must be used with caution. Some consider that there is no indication for their use in anorectal surgery.

Benacol was introduced in 1927 by Yeomans and his co-workers. Infiltration is attended by burning pain which lasts for several hours, and occasionally results in pinpoint abscesses. We have abandoned the use of it.

Gabriel's solution, or A.B.A., was introduced as an inexpensive substitute for Benacol in 1929. Simmons considers this the best of the oil-soluble anesthetics for the control of pain following hemorrhoidectomy. The use of this solution is not without discomfort to the patient.

Morgan's solution was introduced in 1935. He claims painless induction if injected slowly, no severe after-pain, certain and prolonged anesthesia for 7 to 28 days, when used in amounts up to 20 to 30 cc. Reuther has used this solution for anesthesia in minor anal operations, 10 cc. producing no reaction, with skin anesthesia in five minutes. He found the minimal duration of anesthesia to be

five days, the maximal duration 23 days, and the average duration 12 days.

Anucaine, introduced by Gorsch in 1934, was used as an anesthetic agent. In a later paper this observer does not recommend the solution as an operative anesthetic but suggests its use to alleviate postoperative pain. In regard to frequency of complications by its use he reports reactions due to drug sensitivity (prolonged sensory anesthesia, constitutional and local reaction, itching and local urticaria), superficial necrosis and deep abscess. In the majority of cases he has used 5 to 10 cc. of solution for supplementary anesthesia, but in some it has been employed for primary anesthesia.

Neethesol, composed of procaine base, has been advocated. Rennie considers 15 to 20 cc. adequate for most operations and 25 cc. sufficient for hemorrhoidectomy, subcutaneous circumanal injection giving complete anesthesia of the skin.

Nupercaine in oil was early recommended by Steinberg, and is in popular use today.

Zylcaine and Trithesia are two popular injectable anesthetic agents also in use today. Vaughan in a personal communication states that he recently reviewed 250 postoperative cases following the use of Zylcaine with no complications and averaging only one to two hypodermics of Demerol postoperatively.

More recently, Smith states that continuous caudal anesthesia eliminates the zone of severest pain, and following it there is little postoperative medication necessary. The major drawback is that trained help is necessary to instill the Piperocaine at 45 minutes to one hour intervals.

In an attempt to get a cross section opinion of the value of local analgesia and anesthesia, a questionnaire was sent to 100 surgeons and proctologists picked at random, from coast to coast. Forty replies were received. The following graph will summarize these findings:

No. of Replies	Drug	Average No. Postop. Hypodermics	Results
15	No local drug	3	Good
6	Topical drug only	2-3	Fair to Good
12	Oil soluble injectable drug only	1-2	Good
7	Oil soluble injectable drug combined with topical drugs	1-2	Good

Two reports stated that alcohol was substituted when pruritis ani

was coexistent. One used a 20 per cent solution of alcohol while the other used a 95 per cent solution. It was surprising to find that 10 no longer used any form of local analgesia or anesthesia, although they had done so previously and discarded the practice. Zylcaine, Nupercaine in Oil and Eucupin were the injectable drugs of choice, while Nupercainal and Diothane were the topical drugs of choice.

It is interesting to note that 48 per cent of the replies stated that oil-soluble injections, either alone or combined with topical ointments, were used, while 38 per cent used no drug locally. One can see the widely divergent opinions with the strikingly similar results.

It is conceded that the tolerance varies in individuals. It is also conceded that pain is more acute following hemorrhoidectomy than in excision of fistulae in ano or fissures in ano.

We reviewed our last 300 consecutive anorectal operations with emphasis on the amount of local anesthesia in oil used in each case and the number of hypodermics required postoperatively. Of the 300 cases reviewed 216 were operations for radical hemorrhoidectomy. An average of 5 cc. of oil soluble anesthesia was injected subcutaneously, the sphincter muscle also being injected at the same time in each of its four quadrants. These cases average two hypodermics of Dilaudid, 1/32 grain, or Pantopon, 1/3 grain, postoperatively. The first hypodermic was given when the anesthesia subsided, and the second at bedtime. Twenty-two of the cases were for fissure in ano. Small simple fissure operation is done as an office procedure and is not included in this series. In these cases, 1 to 2 cc. of oil soluble anesthesia was used. Thirty of the cases were for fistulae in ano. The remaining 32 cases of anorectal pathology were completed in conjunction with other surgery which required additional hypodermics, not for the anorectal pathology *per se*. The groups for fissure in ano and fistulae in ano required an average of one hypodermic postoperatively. In this series of 268 cases one postoperative hemorrhoidectomy developed a small abscess which promptly subsided during postoperative care. Eleven per cent of this total group had headaches which were attributed to the spinal anesthesia. A "saddle block" type of spinal anesthesia is our anesthesia of choice.

Catheterization was necessary in 27 (10 per cent) of our cases and most noted in the older patients. However, we feel this was primarily due to the spinal anesthesia rather than to the locally injected drug. The 32 cases with additional surgery were not included in this series.

The technic and contraindication of oil soluble anesthetics have not been discussed because they are so generally well known. Nes-

selrod in his recent book states that those who do and those who do not use oil soluble anesthetics have the same number of post-operative abscesses. It has been stated by Marks that the complications are due to poor placement of sutures, constriction of excessive tissue and inadequate drainage. Certainly the use of oil soluble anesthetics does not preclude good surgical technic.

Personal opinion undoubtedly influences such a review as this; however, it is our opinion that pain following anorectal surgery can be definitely minimized by providing prolonged relaxation of the sphincter muscle. In our hands a balanced oil soluble anesthetic agent such as Trithesia or Zylcaine has provided our patients with greater comfort than any other method, and has subjected them, we believe, to little or no additional risks.

It has been stated that to carry a patient through an anorectal operation with little or no after-pain is the dream of every proctologist. Unfortunately, this ultimate goal is still to be attained.

REFERENCES

1. Belt, R. L.: Comfort in cases of anorectal surgery, *Am. J. Surg.* 72:16 (July) 1946.
2. Bloomenthal, E. D., and Bendix, R. M.: Hemorrhoidectomy, *Illinois M. J.* 96:311 (Nov.) 1949.
3. Bowman, F. B.: Local anesthesia in anorectal disease, *Canad. M. A. J.* 39:379 (Oct.) 1938.
4. Daniels, E. A.: Rectal pain, *Internat. Clin.* 3:73 (Sept.) 1940.
5. Green, W. W.: Oil soluble anesthetics in anorectal surgery, presented during meeting of American Proctologic Society, June 6-8, 1937, Atlantic City, N. J.
6. Johnson, L. J., and Schilla, F. W.: Pre- and postoperative care in anorectal surgery, *Tr. Am. Proct. Soc.*, 1950.
7. Lieberman, W.: Oil soluble anesthetics in proctology, *Rev. Gastroenterol.* 15:520 (June) 1948.
8. Marks, M. M.: Rectal medication, *Med. Times* 78:227 (May) 1950.
9. Miller, D.: Relief of anal pain, *Journal Lancet* 70:300 (Aug.) 1950.
10. Scarborough, R. A.: Recent advances in more common problems of minor anorectal surgery, *Surgery* 5:952 (June) 1939.
11. Silvers, H. I.: Pain after anorectal operations, *Med. World* 58:169, 1940.
12. Smith, T. E.: Role of anesthesia in postoperative anorectal pain, *South, M. J.* 44:832 (Sept.) 1951.
13. Thomas, D. E.: Use of oil anesthetics in rectal disease, *Bull. U. S. Army M. Dept.* 9:589 (July) 1949.

RECONSTRUCTIVE BILIARY TRACT SURGERY

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THE earliest successful operation to re-establish the continuity of the biliary and intestinal tract in man was performed in 1880 by Von Winiwarter. After a total of six operations, he accomplished a cholecystenterostomy which was functioning for six months at the time of his report. Two years later in 1882, Langenbuch performed the first successful cholecystectomy. From that time until the present day, the syndrome of complete or almost complete non-calculous obstruction of the biliary tree has presented the surgeon with one of his most difficult and perplexing problems.^{13,23} Many authors have failed to grasp its full scope. Broadly, there are two aspects: 1. Anatomic; the need to establish a continuous lumen between the biliary and intestinal tract. 2. Pathophysiologic; the effect of the reconstruction on the physiology and integrity of the hepatobiliary mechanism as well as the effect of bile on suture lines,⁸ grafted tissues and prosthetic devices.³⁵ These considerations provide the key to the understanding of the eventual clinical failure of an anatomically successful reconstruction.

The various methods of repair may be classified as shown in table 1. Many are devised specifically to meet the pathologic condition present in the operative area.^{3,6,10,11,17,18,30}

1. *Extrahepatic anastomoses or procedures:*

a. Mechanical dilatation of stricture: Probably the earliest reported case in which stricture of a bile duct was treated by mechanical dilatation was that of Parkes in 1885.¹³ This procedure was accomplished by passing a steel sound through a fistula into the gallbladder, thence into the common duct and duodenum. The vast majority of strictures treated by only a single dilatation are sure to recur.⁴⁵ Some men who have had occasion to resort to dilatation have placed a T tube in the duct in the strictured area in an attempt to prevent recurrence. Unfortunately this method also usually fails and the procedure as a whole is not recommended.

b. Excision of stricture with end to end ductal anastomosis: End to end anastomosis of a biliary duct is nearly always successful, especially if carried out immediately after injury,^{10,30,35,45} without

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tension on the suture line,^{30,35} and by a procedure which approximates mucosa to mucosa.³⁰ The use of a T tube or its functional equivalent is advisable to splint the anastomosis and render less likely a recurrence of the stricture at the suture line.

TABLE I

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1. Extrahepatic anastomoses or procedures:
 - a. Mechanical dilatation of stricture.
 - b. Excision of stricture with end to end ductal anastomosis.
 - c. Plastic procedures (choledochoplasty).
 - d. Fistulo-enterostomy.
 1. External.
 2. Internal.
 - e. Direct anastomosis of a portion of the extrahepatic biliary system exclusive of the gallbladder, to the gastrointestinal tract (Choledochointerostomy).
 - f. Alloplastic prosthetic devices.
 - g. Free tissue grafts—autogenous and homologous.
 - h. Viable pedicle grafts.
 2. Intrahepatic anastomoses:
 - a. Hepatoenterostomy.
 - b. Hepatocolangioenterostomy.
 - c. Left hepatodochointerostomy (Roger's operation).
-

Cattell³ reports that he has been able to obtain adequate distal common duct to effect end to end approximation without tension by means of retroduodenal and intrapancreatic dissection. According to his technic the lateral parietal peritoneum fixing the second portion of the duodenum is incised and the duodenum displaced mesially. The head of the pancreas is then split in a coronal plane and the distal common duct dissected free. Whenever possible, end to end repair with prolonged T tube splinting appears to be the procedure of choice.³⁰ However Walters⁴⁴ among others, believes that in average hands the retroduodenal search for the distal common duct will be unsuccessful many more times than it will be fruitful. For this reason and because of the higher incidence of recurrent stricture at the suture line, he prefers choledochoduodenostomy. Dragstedt and Woodward⁶ have simplified the search for the distal and intrapancreatic part of the common duct by employing duodenotomy and probing through the Ampulla of Vater. This neat approach should increase the possibilities of salvaging and using distal common duct for reconstructive procedures.

c. Plastic procedures—choledochoplasty: Various complex plastic procedures, adaptable to only a single case have been described^{16,20,25,42} in which flaps of cystic duct, gallbladder or stomach have

been utilized to reconstruct the distal duct system or to bridge defects between the ducts and the intestinal tract. Moynihan²⁹ in 1905, described a simple and effective procedure for treating a small localized stricture, the technic being patterned after the Heineke-Mikulicz pyloroplasty. In the light of present day knowledge however, any stricture amenable to this type of repair would best be treated by excision and end to end anastomosis.

d. *Fistulo-enterostomy—external*: The operation of fistulo-enterostomy or the transplantation of an established external biliary fistula into some portion of the gastrointestinal tract is mentioned only to be condemned. In 1913 Hugh Williams performed this operation successfully for the first time at the Massachusetts General Hospital. Although at first manifesting great promise in the treatment of biliary stricture, this procedure, in the opinion of many,^{11,45} will fail to function, because of cicatricial contraction within a few months.

Fistulo-enterostomy—internal: In 1909 Sullivan^{39,40} reported a series of experiments on dogs in which he attempted to construct a functioning bile duct from the greater omentum. After sectioning the common bile duct he inserted a rubber tube into its proximal end. The distal end of the tube was run into the duodenum by a modified Witzel technic. The greater omentum was then wrapped around the tube and sutured in place. The tubes were soon passed through the intestine leaving a fistulous tract of omentum. One of the dogs so prepared was sacrificed on the tenth postoperative day. The fistulous tract examined microscopically, disclosed that biliary tract epithelium had grown down to line the proximal portion of the tract, while duodenal mucosa had proliferated to line the distal portion of the tract. Scattered reports of the successful clinical application of the procedure then appeared in the literature. However, W. J. Mayo,²⁶ commenting on it, stated that although the temporary results are at times excellent, eventual fibrous stricture made the final outcome unsatisfactory. There has been no reason to reject Mayo's evaluation.

e. *Direct anastomosis of a portion of the extrahepatic biliary system exclusive of the gallbladder to the gastrointestinal tract—cholechocho-enterostomy*: Cholechocho-gastrostomy a procedure advocated by one author¹² utilizes the mucosa and submucosa of the stomach to reconstruct a biliary duct. The first reported case of cholechochoduodenostomy was that of Sprengel's³⁸ in 1891, in which the anastomosis was made between the side of a distended common duct and the side of the duodenum. In the succeeding few years, this procedure or a slight modification of it was practiced by several

surgeons. Many made use of the Murphy button to accomplish this anastomosis rapidly. In 1905, W. J. Mayo²⁴ reported 2 cases of common hepatodochoduodenostomy, one of which was successful. The anastomosis may be performed over a rubber tube in order to lessen the danger of immediate postoperative inflammatory occlusion. Common hepatodochoduodenostomy has been considered by many^{17,18,26,30,43,44} to be a satisfactory and highly successful procedure.

One of the most common complications of surgery for stricture is postoperative cholangitis.¹¹ Attacks of pain, fever, jaundice, nausea, and vomiting, occur at variable intervals during the first year or so postoperatively and then gradually cease. It has been the opinion of almost all men engaged in this field that the cholangitis is an ascending infection, resulting from a reflux of infected duodenal contents into the biliary system due to the lack of a physiologic sphincter. Many varied and ingenious methods have been attempted to either produce a sphincter mechanism or to divert the intestinal stream away from the anastomotic site.^{2,15,45,46}

If a competent valve cannot be constructed to prevent duodenal reflux, some short circuiting procedure by means of which the intestinal contents may be shunted around the anastomosis should serve the same purpose. In 1904 Monprofit²⁷ reported on a cholecystojejunostomy, the anastomosis being fashioned after the Roux Y technic. In 1908 Monprofit²⁸ adapted this procedure for a choledochojejunostomy. The jejunum was divided and the distal stump closed. The common bile duct was then anastomosed end to side to this loop of distal jejunum a few centimeters distal to the closed stump. Intestinal continuity was re-established by an end to side jejunojejunostomy several inches distal to the entrance of the bile duct. Within the following year Monprofit's method was used in 2 reported cases with clinical success. Little more was heard about this procedure as suggested by Monprofit until 1945 when A. W. Allen¹ reported his excellent results using the technic with a few minor modifications. Allen utilizes the distal loop of jejunum in an end to end union with the bile duct, after the wall of the jejunal end is inverted for 1 to 2 cm. The intestinal continuity is re-established, and the Roux Y completed by anastomosing the proximal jejunum, end to side, several inches below the entrance of the bile duct. The author reports eight operations, all the patients doing well, with his longest follow-up of two years.

f. Alloplastic prosthetic devices: The various substances used to bridge and splint biliary intestinal anastomoses include decalcified plates of bone,¹³ decalcified tubes of bone,¹³ rubber, latex, and vitallium tubes³² and most recently tubes of polyethylene plastic or

"bouncing clay."¹⁰ The decalcified bone tubes as used by Mayo Robson and others¹³ undoubtedly were passed per anum within a very short time, their only function being to maintain the anastomosis patent through the critical period of postoperative inflammatory edema. The hopes that rubber or latex tubes could be used to bridge defects or permanently intubate the bile passages have been disappointing time and again. These tubes are usually passed by peristaltic action into the intestine.⁵ If this does not occur and they remain in situ for long periods, they invariably become plugged with inspissated bile.^{11,19} However, in a case known to one of us (A.E.P), a rubber tube served as a functioning prosthesis for nine years before obstruction occurred.

In 1941 Herman Pearse³² reported on a technic for choledochostomy employing an inlying vitallium tube. In the succeeding few years, the vitallium tube was hailed as one of the major and most significant advances in reconstructive biliary surgery. At the time of its inception, it was stated by several authors⁴ that since vitallium is virtually nonreactive in tissue, there was no cause to fear that the tubes would become plugged with bile. Follow-up studies of patients less than five years postoperatively however, have shown that more than 12 per cent of the tubes which remain in place become plugged with bile.³⁴ Pearse has emphasized that the specific use of his tubes is for choledochostomies, when the tissue of the duct can be approximated over the tube. If the tube is used to bridge a wide gap in duct substance, there is danger of the ends of the duct pulling off of the tube.³³ If one end of the tube is implanted into the intestine, there is a great possibility of its being passed through the intestinal tract.³⁴ Of 106 cases collected by Pearse, in which the vitallium tube was used as recommended for choledochostomies, 80.1 per cent were considered successful.

Tubes of polyethylene or "bouncing clay" have as yet not been used in enough cases to draw definite conclusions. However, it is thought that if such tubes are used for permanent prostheses, most if not all will eventually obstruct.¹⁰

g. Free tissue grafts—autogenous and homologous. The attempted transplantation of either intra-abdominal or extra-abdominal tissues to form a new channel for bile is not a new idea. In 1913 a group of investigators⁷ attempted to reconstruct the common bile duct by using free fascial grafts. Eight of 11 experimental animals died and the 3 surviving dogs were sacrificed after two months, a period which in our experience is far too short for accurate evaluation. However, even in this short time one of the grafts had contracted sufficiently to cause complete biliary obstruction. More

recently a series of experiments²² were performed in which pieces of fascia removed from the rectus muscle were sutured around a Pearse tube. The severed ends of the common duct were then sutured to the fascia. All of the dogs operated upon lived to be sacrificed at the end of 90 days, which again, was a short experimental period. Examination of the graft showed that it had contracted to half of its original length, and there was no epithelization of the internal surface. It is interesting to note that in 2 animals the Pearse tube slipped out, and without this frame, the graft had contracted so that a complete stricture had formed. Although their statistics as to mortality are excellent, we believe that the autopsy findings justify the assumption that a significant percentage of all such fascial grafts would stricture and occlude if a longer survival time were granted.

There have been several attempts recorded in the literature^{14,22,37} in which a free segment of vein was used experimentally to bridge a defect in the continuity of the biliary ducts. One of the earliest and most carefully conducted experiments were those of Horsley.¹⁴ His results were uniformly poor. Immediate postoperative death was caused by bile leakage at the suture lines. Late deaths resulted from occlusion of the venous segment due to cicatricial contraction. The venous segments examined microscopically showed marked inflammatory infiltration of the vein. This inflammatory reaction undoubtedly was the precursor of later fibrous occlusion. There was no epithelization of the graft.

Horsley's work discouraged further attempts to utilize free vein grafts until 1943. In that year a series of experiments were reported²² in which a segment of femoral vein was placed on a Pearse tube and this combined prosthesis sutured to the divided distal and proximal common duct. Six of 10 dogs survived the experimental period, 90 days. Autopsy of these animals disclosed very marked contraction of the venous segment. In 2 cases scar contraction was so marked that the venous segment had shrunk to less than 2 mm. in length. The microscopic reports showed that some slight degree of epithelization had occurred on the graft.

In 1948, Shea and Hubay³⁷ reported their experiments with the use of free vein grafts. They utilized the Lord and Blakemore vitallium cuffs to effect their anastomoses (choledochophlebochole-
dochostomies). They reported 21 animals operated upon, with success in 66 per cent. Two of us, A.E.P. and A.W.U.,³⁵ in 1946, independently conceived this same idea. We operated upon 32 animals using this technic and careful evaluation of results in animals surviving up to 230 days have shown that about one third of the grafts fail because of immediate necrosis and perforation of the vein. The

remainder are doomed to eventual complete fibrous occlusion. Further work using autogenous and homologous free grafts of arteries, ureters and common duct itself, both fresh and preserved in Gross' solution, in 30 animals have likewise proved unsuccessful.⁴¹

h. Viable pedicle grafts: It has become obvious to us that no tissue graft will survive transplantation into the biliary ducts unless it is viable and has an established independent vascular supply. Accordingly, we (A.W.U. and J.H.E.) have recently developed a two stage procedure for ductal reconstruction. The first stage consists of securing a suitable section of vein and tying it over a polyethylene tube. The vein and tube are then wrapped and anchored in omentum and allowed to remain in the abdominal cavity of the animal for six to eight weeks. This effects vascularization of the vein graft. The second stage consists of anastomosing the vein segment with omentum attached in a defect in the biliary system. This work is still in its early stages and conclusions as to its feasibility cannot yet be ventured. In our pilot experiment, the dog with a vascularized swing graft was sacrificed after eight months (November 1951). The result in every respect was excellent.

2. *Intrahepatic anastomoses:*

a. Hepatoenterostomy: Hepatoenterostomy was first suggested in 1897 by Langenbuch.¹² Kehr¹³ in 1904, reported on the first successful case, and scattered reports have appeared in the literature since then by authors^{10,18} describing one case, usually unsuccessful. The technic employed was to incise the sharp margin of the liver with a scalpel. The liver incision was then deepened into the parenchyma with the cautery. The duodenum or jejunum was then incised longitudinally and the anastomosis made by suturing the intestinal stoma to Glisson's capsule. Most of the unsuccessful cases showed at autopsy that granulation tissue had occluded the tiny hepatic biliary ducts so that bile could not enter the intestine. The procedure of hepatoenterostomy as above described should be completely discarded.

b. Hepatocholelangoenterostomy: Recently however, a modification of the technic of hepatoenterostomy has been introduced into the surgical literature by Longmire.²¹ The procedure has been termed cholelangojejunostomy and is associated with a partial left lobe hepatectomy. According to his technic the left lobe of the liver is carefully incised between hemostatic sutures until a large intrahepatic bile channel is found. This channel is then dissected free of the surrounding liver for a distance sufficient to allow for anastomosis with the jejunum. The anastomosis is performed mucosa to mucosa and the serosa of the bowel is sutured to the cut edge of Glisson's

capsule to peritonealize the raw hepatic surface. An entero-enterostomy is performed proximally. Six cases have so far been operated upon, 3 of which were successful. Cholangiojejunostomy is not a procedure of choice and should be resorted to only after other usual methods of duct reconstruction have proved impossible.

As noted by Longmire²¹ and re-emphasized by Lahey,¹⁹ in order for this procedure to adequately drain both major lobes of the liver, the continuity between the right and left hepatic ducts must be intact. Thus the bile from the right lobe of the liver may be carried by retrograde drainage up the left hepatic duct and biliary channels through the anastomosis, and thence into the intestine.

c. Left hepatodochenterostomy (Roger's operation³⁶): The most recent contribution toward the solution of the problem of ductal reconstruction was based on autopsy dissections which showed that adequate lengths of left hepatic duct could be dissected free from the left lobe of the liver just under the capsule of Glisson. According to this technic the left hepatic duct is found and traced back under the capsule of Glisson. The duct is ligated proximally and the length of left hepatic duct obtained is swung downwards and anastomosed to either the remnants of the common duct or to proximal intestine. It is obvious that for this procedure to be successful the integrity of the junction between right and left hepatic ducts must be intact. An important factor we believe, which contributes to the success of this procedure experimentally, is the presence of a constant artery running along with the left hepatic duct. This assures a viable margin of the swing graft for the anastomosis.

SUMMARY

1. The problem of biliary reconstruction is briefly stated.
2. The more significant methods of repair are assembled and for the first time suitably classified.
3. New experimental technics are discussed.

REFERENCES

1. Allen, A. W.: Method of reestablishing continuity between bile ducts and gastrointestinal tract, *Tr. South. S. A.* (1944) 56:28, 1945.
2. Balfour, D. C.: Technic of hepaticoduodenostomy with some notes on reconstructive surgery of biliary ducts, *Ann. Surg.* 73:343 (March) 1921.
3. Cattell, R. B.: Benign strictures of biliary ducts, *J.A.M.A.* 134:235 (May 17) 1947.
4. Clute, H. M.: Bile duct reconstruction with vitallium tubes, *New England J. Med.* 226:484 (March 19) 1942.
5. Cole, W. H.; Ireneus, C., Jr., and Reynolds, J. T.: Use of vitallium tubes in strictures and absence of common bile duct, *Ann. Surg.* 122:490 (Oct.) 1945.
6. Colp, R.: Hepaticoduodenal intubation with hepatoduodenostomy for traumatic stricture of hepatic duct, *Surg., Gynec. & Obst.* 80:190 (Feb.) 1945.

7. Davis, C. R., and Lewis, D. D., cited by Horgan¹³.
8. Douglass, T. C.; Lounsbury, B. F.; Cutter, W. W., and Wetzel, N.: Experimental study of healing in common bile duct, *Surg., Gynec. & Obst.* 91:301 (Sept.) 1950.
9. Dragstedt, L. R., and Woodward, E. R.: Transduodenal reconstruction of bile ducts, *Surg., Gynec. & Obst.* 94:53 (Jan.) 1952.
10. Eliot, E., Jr.: Repair and reconstruction of hepatic and common bile ducts, *Surg., Gynec. & Obst.* 26:81 (Jan.) 1918.
11. Eliot, E., Jr.: Benign cicatricial strictures of bile ducts, *Ann. Surg.* 104:668 (Oct.) 1936.
12. Hoag, C. L.: Reconstruction of bile ducts; new method of anastomosis, *Surg., Gynec. & Obst.* 64:1051 (June) 1937.
13. Horgan, E.: *Reconstruction of the Biliary Tract*, New York, Macmillan Company, 1932.
14. Horsley, J. S.: Reconstruction of common bile duct, *J.A.M.A.* 71:1188 (Oct. 12) 1918.
15. Jackson, R. H.: Anterior choledochojejunostomy, *Surg., Gynec. & Obst.* 19:232 (Aug.) 1914.
16. Judd, E. S., and Burden, V. G.: Postoperative stricture of common bile duct, *Ann. Surg.* 80:210 (Aug.) 1924.
17. Judd, E. S., and Burden, V. G.: Benign stricture of bile ducts, *Arch. Surg.* 11:459 (Sept.) 1925.
18. Lahey, F. H.: Strictures of common and hepatic ducts, *Ann. Surg.* 105:765 (May) 1937.
19. Lahey, F. H.: Further experiences with injured bile ducts, *New England J. Med.* 240:161 (Feb. 3) 1949.
20. Liebold, Hans, cited by Horgan¹³.
21. Longmire, W. P., Jr.: Intrahepatic cholangiojejunostomy with partial hepatectomy for biliary obstruction, *Surgery* 24:264 (Aug.) 1948.
22. Lord, J. W., Jr., and Cheroweth, A. I.: Free graft over vitallium tube for bridging gap in common bile duct of dog, *Arch. Surg.* 46:245 (Feb.) 1943.
23. McWhorter, G. L.: Clinical and experimental operations on gallbladder and common duct, *Arch. Surg.* 35:1099 (Dec.) 1937.
24. Mayo, W. J.: Some remarks on cases involving operative loss of continuity of common bile duct, *Ann. Surg.* 42:90 (July) 1905.
25. Mayo, W. J.: Restoration of bile passages after serious injury of common or hepatic ducts, *Surg., Gynec. & Obst.* 22:1 (Jan.) 1916.
26. Mayo, W. J.: Surgery of hepatic and common bile ducts, *Lancet* 1:1299 (June 30) 1923.
27. Monprofit, A. (1904), cited by Horgan¹³.
28. Monprofit, A. (1908), cited by Horgan¹³.
29. Moynihan, B.: Case of simple stricture of common bile duct treated by plastic operation, *Brit. M. J.* 2:1390, 1905.
30. Nygaard, K. K.; Shelden, C. H., and Walters, W.: Strictures of bile ducts; results in fifty-one operative cases, *Proc. Staff Meet., Mayo Clin.* 12:25 (Jan. 13) 1937.
31. Parkes, C. T., cited by Horgan¹³.
32. Pearse, H. E.: Benign stricture of bile ducts treated with vitallium tube, *Surgery* 10:37 (July) 1941.
33. Pearse, H. E.: Vitallium tubes in biliary surgery, *Ann. Surg.* 115:1031 (June) 1942.
34. Pearse, H. E.: Results from using vitallium tubes in biliary surgery, *Ann. Surg.* 124:1020 (Dec.) 1946.
35. Pearce, A. E.; Ulin, A. W.; Entine, J. H., and Proio, G.: Experimental reconstruction of extrahepatic biliary system using free venous grafts, *Ann. Surg.* 134:808 (Nov.) 1951.
36. Rogers, C. S.: Use of left hepatic duct to bypass defects in common duct (*Surgical Forum* Oct. 1950) Philadelphia, W. B. Saunders Company, 1951, p. 183.
37. Shea, P. C., Jr., and Hubay, C. A.: Experimental repair of common duct defects utilizing free vein graft over Blakemore-Lord tubes, *Ann. Surg.* 128:21 (July) 1948.

38. Sprengel, cited by Horgan¹³.
39. Sullivan, A. G.: Reconstruction of bile ducts, *J.A.M.A.* 53:774 (Sept. 4) 1909.
40. Sullivan, A. G.: Reconstruction of bile ducts, *J.A.M.A.* 58:2026 (June 29) 1912.
41. Ulin, A. W.; Van Ess, L.; Pearce, A. E., and Entine, J. H.: Experimental reconstruction of common bile duct using autogenous and homologous fresh and preserved free grafts of arteries, ureters and common duct. To be published.
42. Von Stubenrauch, cited by Horgan¹³.
43. Walters, W.: Strictures of common and hepatic bile ducts; postoperative progress in seventeen cases, *Surg., Gynec. & Obst.* 48:305 (March) 1929.
44. Walters, W.: Strictures of common and hepatic bile ducts and their treatment, *S. Clin. North America* 30:987 (Aug.) 1950.
45. Walton, J.: Reconstruction of common bile duct, *Surg., Gynec. & Obst.* 79:57 (July) 1944.
46. Wilson, G. E.: Benign stricture of bile duct with new method of treatment, *Surg., Gynec. & Obst.* 68:288 (Feb. no. 2A) 1939.

CARCINOMA OF THE LARGE INTESTINE

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CARCINOMA of the large bowel if sufficiently neglected will usually eventually force the patient to seek help because of either intestinal obstruction, wasting and anemia from infection or melena, because of symptoms of perforation or other processes associated with the progression of the primary lesion, or because of symptoms resulting from metastasis. In the early history of the disease it seems that most cases were recognized, if at all, because of evidence of obstruction or other late manifestations. While it is true that facilities for early diagnosis are generally readily available and that a fair number of reasonably early cases are being detected and treated, it is still true that most patients having carcinoma of the bowel are found to have well advanced lesions at the time of original diagnosis and treatment.

Also, in the fairly recent history of bowel cancer, surgical treatment with excellent technic was associated with a mortality rate well above that of surgical procedures of comparable extent in other regions. Various excellent and ingenious procedures were devised in order to reduce this mortality: for instance, the two stage resection, the Mikulicz's exteriorization technic, the methods of closed so-called aseptic anastomosis, and the Balfour method of passing a colon tube up the anus through an anastomosis involving the rectal stump. All are good methods and some are still useful and at times indispensable.

Today with perfected methods preoperative preparation including emptying of the bowel, chemotherapy and antibiotics, maintenance of blood volume, and other supportive measures, extensive surgical procedures in the bowel are carried out by experienced surgeons and by some not so experienced with a mortality rate little or no higher than that of comparable procedures in other regions. While this lower operative mortality is very desirable and is undoubtedly a great achievement, it merely means that more patients survive the operation. We are still faced with considerable evidence that the percentage of five year cures resulting from surgical treatment has increased little if any.

Failure of the patient to remain free of bowel cancer following operation is in many instances due to failure, inability, or impossibility of removing all malignant tissue present at the time of opera-

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tion, most frequently because of the presence of irremovable metastases.

Some failures may be due to inadequately wide excision of removable tissue by the surgeon at his operation, including extent of resection of bowel, of the lymph node bearing area, and other removable tissue adjacent to the growth. This item is so important and so well recognized that narrow segmental resection for cancer has been generally abandoned except as a palliative procedure in patients known to have hopeless disease. For instance, if a patient has an invasive carcinoma of any part of the right colon or right transverse colon, the operation will consist of no less than a right hemicolectomy. If the lesion is in the descending colon or splenic flexure or proximal sigmoid, the operation will usually be no less than a left hemicolectomy. Wide resections require more adequate exposure and may require a little more time but the technic seems to be actually easier, the node bearing area comes away with less difficulty, and the patient seems to do better in every way. When dealing with lesions of the lower rectum, adequate removal of tissue is often extremely difficult, and it is in this region that true local recurrence most often occurs.

The possibility should be pointed out that a patient might have a primary carcinoma with all of its extension completely removed and still not be permanently relieved of cancer of the bowel. Such a patient could and occasionally does return in a period varying from a few weeks to a number of years suffering from bowel cancer. This is possible because: 1. The patient may have had one or more additional unrecognized primary bowel cancers at the time of the initial operation. 2. The residual bowel may have contained one or more premalignant lesions, usually adenomatous polyps, which later developed into cancer. 3. The residual bowel may have been completely free of disease and yet developed an entirely new and independent primary lesion at a later time.

It should be mentioned here that Goligher and associates have recently presented evidence that the lumen of the bowel, especially that distal to the lesions, may contain viable malignant cells and that in the course of the operation some of these cells may be implanted into the wound where they grow and constitute one type of recurrence.

It is important to have the possible causes of failure well in mind at all times; before operation, during operation, and after operation. It is well to remember that before operation it should not be taken for granted that the first lesion discovered is the only one present. On the other hand, in addition to the usual search for

metastases, every possible means should be used to exclude the possibility of multiple lesions. Occasionally an examining physician who wishes to assure his patient that his bowel is free of trouble, will simply order a barium enema and roentgenogram of colon, sometimes without even taking the trouble to do a digital examination of the rectum. This is very bad practice because most competent roentgenologists will testify that routine roentgenograms of the colon will often fail to demonstrate even well advanced lesions in the distal colon and rectum. Even when roentgenologic examination does reveal a lesion in the more proximal colon, digital and sigmoidoscopic examinations are essential in order to investigate the rectosigmoid area. As a result of unfortunate experience, our group has adopted a rule to the effect that no routine roentgenogram of the colon may be ordered until sigmoidoscopic examination has been done, unless there is a valid reason for exception.

During the operation, in addition to the usual search for evidence of growth in the peritoneum, nodes, liver, or other extension of the primary lesion, the supposedly uninvolved portion of the bowel should be investigated. If restoration of continuity is planned, open anastomosis is usually the method of choice and therefore the proximal and distal ends can be aspirated and inspected. At times endoscopic instruments may be useful for this purpose.

After operation and convalescence comes the periodic follow-up. In some instances the initial operation may have been done as an emergency, and there may have been obstruction or other conditions contraindicating adequate preoperative investigation. Under such circumstances it would seem very desirable, regardless of how well the patient seems to be doing, to complete the investigation in the early follow-up period, so as to permit recognition and treatment of additional lesions which may have been unrecognized during the emergency period. In any event, thorough follow-up examinations seem well worth while. If there is a colostomy, digital and endoscopic examinations along with barium enema can easily be done through the stoma for the purpose of detecting residual or new lesions. If the patient with a colostomy following combined abdominoperineal resection is a female, vaginal examination may yield some information relative to deposits in the pelvis or in the perineum. While it seems worth while to know about such perineal recurrences, so far as I know, usually very little worth while can be done about them. However, the prospect with the proximal bowel is at times much better. There is now enough recorded experience to prove the value of recognizing new lesions following bowel resection for malignancy and of distinguishing between them and true recur-

rence. Usually, the prognosis is much better when dealing with a new lesion than it is with a true recurrence, and in doubtful cases, exploratory operation may prove well worth while.

If there is no colostomy and primary anastomosis has been done, in many cases the site of the anastomosis and regional mucosa can be inspected through the sigmoidoscope. This permits opportunity for detection and disposal of new lesions and, in addition, an early recurrence at the site of anastomosis may occasionally be detected and sometimes successfully removed. Barium enema, including double contrast studies, is necessarily a part of the check-up.

At the present time, it seems that multiple malignant lesions according to available statistics are found present in about 8 per cent of patients undergoing operation for cancer of the bowel. If benign polyps are included, the total number having multiple lesions seems to be about 34 per cent or more. It also seems entirely possible that with increasing realization of the possibility of multiple lesions and more careful search for them, the true incidence may prove to be considerably higher.

SUMMARY

Some of the evolution and progress in surgical treatment of cancer of the bowel has been discussed.

Undoubtedly, operative survival rate has improved, but progress in permanent relief of the malignancy is debatable.

Thorough diagnostic survey and appraisal of conditions present during the preoperative, operative, and postoperative periods are stressed with emphasis on the fact that the first lesion discovered is not necessarily the only one present.

The importance of distinguishing between recurrence and new and independent primary lesions is presented, emphasizing the more favorable prognosis when dealing with new primary as contrasted with the less favorable recurrent or metastatic lesion.

REFERENCES

1. Bargen, J. A., and Rankin, F. W.: Multiple carcinomata of large intestine, *Ann. Surg.* 91:583 (April) 1930.
2. Cattell, R. B.: Surgical treatment of polyps of large intestine, *Am. J. Surg.* 76:733 (Dec.) 1948.
3. DeMuth, Wm. E. Jr.: Chernev, P. J., and Fitts, Wm. T., Jr.: Adenomatous polyps of colon and rectum, *Gyn. & Obst.* 94:2, 195 (Feb.) 1952.
4. Dunphy, J. E. Recurrent cancer of colon and rectum: report of cases with favorable results following radical surgery, *New England J. Med.* 237:111 (July) 1947.
5. Goligher, J. C.; Dukes, C. E., and Bussey, H. J. R.: Local recurrences after sphincter-saving excisions for carcinoma of rectosigmoid, *Brit. J. Surg.* 34:155, 199 (Nov.) 1951.

6. Gregg, R. O., and Dixon, C. F.: Recurrent carcinoma of colon: report of 4 cases, *Proc. Staff Meet., Mayo Clinic*, 16:177 (March 19) 1941.
7. Helwig, E. B.: Evolution of adenomas of large intestine and their relation to carcinoma, *Surg., Gynec. & Obst.* 84:36 (Jan.) 1947.
8. Long, J. W.; Mayo, C. W.; Dockerty, M. B., and Judd, E. S., Jr.: Recurrent versus new and independent carcinomas of colon and rectum, *Proc. Staff Meet., Mayo Clinic* 25:169 (April 12) 1950.
9. Mayo, C. W., and Schlicke, C. P.: Carcinoma of colon and rectum; study of metastasis and recurrences, *Surg., Gynec. & Obst.* 74:83 (Jan.) 1942.
10. Swinton, N. W.: Diagnosis and treatment of mucosal polyps of rectum and colon, with early malignant change, *Am. J. Surg.* 75:369 (Feb.) 1948.
11. Swinton, N. W., and Haug, A. D.: Frequency of precancerous lesions in rectum and colon, *Lahey Clin. Bull.* 5:84 (Jan.) 1947.
12. Swinton, N. W., and Warren, S.: Polyps of colon and rectum and their relation to malignancy, *J.A.M.A.* 113:1927 (Nov. 25) 1939.
13. Thompson, J. W.: Secondary resections in recurring carcinoma of colon, *J.A.M.A.* 107:1688 (Nov. 21) 1936.
14. Warren, S., and Gates, O.: Multiple primary malignant tumors; survey of literature and statistical study, *Am. J. Cancer* 16:1358 (Nov.) 1932.

THE SURGICAL MANAGEMENT OF DIVERTICULITIS OF THE COLON

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DIVERTICULITIS *per se* is primarily a medical disease. The surgeon's interest is directed toward its complications. The variety of serious complications which may be associated with diverticulitis are seldom associated with any other intra-abdominal disease. Of some interest is the frequency with which asymptomatic diverticula are demonstrated by the roentgenologist. The frequency of diverticulosis has been variously reported. It has been estimated that more than 5 per cent of all individuals over 40 years of age have diverticulosis of the colon. In excess of 47,000 roentgenologic examinations of the colon made at the Mayo Clinic the incidence of diverticulosis was 8.5 per cent.¹ One may encounter diverticula in any segment of the colon from the cecum to and including the rectum; however, rarely in the latter segment. The sigmoid and descending colon comprise the segments most frequently involved.

Diverticulosis seems to occur with equal frequency in the two sexes, while diverticulitis is more prevalent in the male. In those patients having diverticulitis requiring surgical intervention the ratio of males to females has been reported to be 2 to 1.²

It is not known what proportion of the cases of diverticulosis will develop symptoms resulting from diverticulitis. It has been estimated that 10 to 20 per cent of all patients with diverticulosis will develop symptoms of diverticulitis, and about 25 per cent of the patients with a diverticulitis will require surgical intervention for the ensuing complications.

It is generally agreed that diverticula are not congenital. They are rarely, if ever, demonstrated in children, and are seldom seen in patients under 40 years of age. The mechanism by which they form is not clear. Their appearance in the fifth and sixth decades of life is more than coincidental. There must be a direct relationship between the formation of diverticula and the degenerative changes that take place in many people of this age group. Since the sigmoid is involved in about 75 per cent of the cases, there are probably other factors involved in the formation of diverticula, such as narrow lumen, stasis and solid fecal material. The propulsive mechanism of this portion of the bowel and its tendency to spasm have been suggested as additional factors.²

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The symptoms of diverticulitis can be so varied as to simulate many other intra-abdominal diseases. These symptoms are fundamentally the symptoms of acute inflammation and obstruction. The similarity to other intra-abdominal diseases depends upon the location of the process and the degree and type of complication. The obstruction may be acute or chronic. The acute form of obstruction is the result of tissue changes which might take place in the presence of any acute inflammatory process. The chronic obstruction is due largely to hypertrophy of the muscular layer, to fibrosis and to angulations due to adhesions and edema. The obstructive signs are those which might be associated with a new growth, namely: constipation, low abdominal cramping, distention, diarrhea, a feeling of incomplete defecation, bleeding and left lower quadrant tenderness.

The classical symptoms of acute diverticulitis of the sigmoid colon may be listed as pain in the left lower quadrant of the abdomen, nausea, vomiting, slight distention, tenderness, muscle guarding, leukocytosis and a low grade fever. Also a palpable mass may be present. This syndrome is that of acute appendicitis confined to the left lower quadrant of the abdomen. The condition has been referred to as "left-sided appendicitis." A patient with chronic recurrent sigmoiditis due to diverticulitis might easily be diagnosed as having pelvic inflammatory disease. Acute diverticulitis of the cecum, ascending and transverse colon will most likely be diagnosed as acute appendicitis, since pain and tenderness are the cardinal signs of either process.

The symptoms of urinary tract infection, such as frequency, urgency and dysuria might well be due to vesicosigmoidal fistula. These symptoms may be so severe as to divert the patient's attention from any colonic dysfunction. A history of pneumaturia and passing fecal material from the urethra would be conclusive evidence that a vesicocolonic fistula did exist. Most enterovesical fistulas can be demonstrated on cystoscopic examination. The acute perforation of a diverticulum into the free peritoneal cavity is accompanied by sudden sharp pain, signs of generalized peritonitis, shock, chill with elevation of temperature, leukocytosis, rapid, thready pulse, abdominal rigidity and tenderness. Fortunately, free perforations are rare.

The earlier writers would have us believe that bleeding associated with diverticulitis is a rarity. Most authorities now agree that diverticulitis can be a source of bleeding. However, it is doubtful that hemorrhage associated with diverticulitis occurs as consistently as bleeding from carcinoma.

The true diagnosis of diverticulosis or diverticulitis depends upon the ability to demonstrate diverticula. Only very rarely will one be successful in demonstrating a diverticulum by sigmoidoscopy. The value of the examination is not limited to such demonstration. The real purpose is to determine whether or not a new growth is present. However, should sigmoidoscopy reveal fixation of the bowel, unusual sacculaton, angulation, edema of the mucous membrane or the presence of diverticula, such findings would be suggestive of diverticulitis. The roentgenologic examination of the colon is our only means of demonstrating diverticula, and without such evidence a true diagnosis of diverticulitis cannot be made. The problem of differential diagnosis involves the consideration of many abdominal conditions, such as acute appendicitis, carcinoma, pelvic inflammatory disease, chronic ulcerative colitis, amebiasis, bleeding polyp, tubal pregnancy and ovarian cyst with twisted pedicle.

The differential diagnosis of perforated diverticulum, perforated appendix, ruptured ectopic pregnancy, perforated peptic ulcer and mesenteric thrombosis is a most difficult problem. The true pathology is usually discovered at the time of exploration of the abdomen.

Most important in the differential diagnosis is consideration of the presence of carcinoma. Obstructive diverticulitis and carcinoma have many factors in common. Both will produce such signs and symptoms as bleeding, low abdominal cramping, diarrhea or constipation, and a feeling of incomplete defecation. The two disease processes most frequently occur in patients of the same age groups, and both have a predilection for the left side of the colon. In 80 to 85 per cent the diverticulitis is confined to the sigmoid colon,⁴ whereas carcinoma most frequently involves the rectum and rectosigmoid. Visualization of the deformity by means of the barium enema is the most important aid, yet this is not always sufficient to be conclusive. The demonstration of diverticula, a long filling defect, or a complete obstruction to the barium column is suggestive of diverticulitis. It should be remembered that diverticulitis and carcinoma may co-exist. Even with the questionable segment of bowel under direct vision it is not always possible to make the correct differential diagnosis.

Acute inflammatory disease of the female adnexa might pose a problem in differentiation. With the close proximity of the sigmoid to the uterus and adnexa they not infrequently become adherent. A disease process of either one might be the adhesive factor. With the wide usage of chemotherapy and antibiotics pelvic inflammatory disease will be less frequently encountered. Furthermore, diverticulitis seldom occurs in patients before 40 years of age, whereas

pelvic inflammatory disease rarely occurs in patients after 40 years of age.

As stated at the outset, diverticulitis is primarily a disease best managed by a medical regime. The surgeon's province in diverticulitis is limited to the complicating factors of the disease. The indications for surgery are (1) acute perforation, (2) abscess, (3) vesicosigmoidal fistula, (4) co-existing carcinoma, (5) complete obstruction, (6) repeated attacks of diverticulitis notwithstanding medical management, and finally (7) inability to rule out carcinoma.

Patients with acute perforation complicating diverticulitis require thorough preoperative and postoperative supportive measures, as well as chemotherapy and antibiotics. The surgical procedure which might be employed would depend upon the general condition of the patient and the findings at the time of the exploration. In selected patients the affected segment of the bowel may be exteriorized and resected at a later date. If this cannot be done without risk of spreading the infection by entering the tissue planes, other methods of management should be considered. In extremely poor risk patients one might institute simple drainage only. If the patient survives and develops a fecal fistula, this can be considered at a later date. The final choice of treatment would be to close the perforation, establish drainage and divert the fecal stream. The type of diversion, whether it be a simple loop colostomy in the transverse colon or Mikulicz type, would depend upon the individual surgeon. After the inflammatory process has subsided the involved segment may be resected with closure of the colostomy in due time.

The most frequent complication of diverticulitis is a walled off peridiverticular abscess. Some authors advocate medical management with antibiotics in hope that the abscess will disappear. If drainage of the abscess is delayed for an undue length of time, it may rupture into the rectum; or perforate the bladder forming a colovesical fistula. Even if the abscess should subside from the use of antibiotics the patient is not permanently cured. The extraperitoneal approach should be used whenever possible to drain an abscess. If the abdominal approach is used a colostomy in the transverse colon should be established. The bowel can then be adequately prepared for resection of the diseased segment.

A complete diversion of the fecal stream should be carried out in any patient with external fecal fistula or colovesical fistula. This is best accomplished with a transverse colostomy, preferably in the right half of the colon so it will not interfere with mobilization of the left colon at subsequent resection and anastomosis.

It has been observed that most fistulas will heal spontaneously after the fecal stream has been completely diverted. However, this does not mean one should close the colostomy without further surgical intervention. Simple closure of the colostomy has been followed so frequently by reactivation of the diverticulitis that it should rarely ever be advised.⁴ Pemberton and his associates advised against closing colostomies which have been established for diverticulitis and its complications without further surgical treatment.¹ In the presence of complete obstruction one has no alternative to a colostomy, preferably in the right half of the transverse colon. A cecostomy will partially deflate distended bowel but will not divert the fecal stream.

Most authors advise a delay of 6 to 12 months after establishing a colostomy before attempting resection. With the known efficacy of chemotherapy and antibiotics this delay can now be greatly reduced with impunity. Furthermore, one is frequently unable to determine the nature of the obstructing agent. In those patients with co-existing carcinoma and the inability to differentiate carcinoma and diverticulitis, the surgical management will probably not differ with the management of known carcinoma in a similar segment of bowel.

An analysis of 17 private patients with complications of diverticulitis forms the nucleus of this study. The diagnosis was confirmed by the pathologist, exploration and roentgenologic studies. All of the patients were white. There were 10 males and 7 females. The ages ranged from 42 to 81 years. There were 14 patients over 50 years of age.

There were 2 patients in whom a solitary diverticulum was the source of the pathology, 1 in the cecum and the other in the transverse colon. In 14 patients the diverticulosis was confined to the descending and sigmoid colon. There was 1 patient in whom the diverticulosis was demonstrated to be diffuse.

TABLE 1
Roentgenologic Diagnosis

Diagnosis	Cases
*Diverticulitis and Carcinoma.....	4
Obstructing lesion, probably carcinoma.....	3
Obstructing lesion, nature indeterminate.....	1
Carcinoma	5
Diverticulitis or Diverticulosis.....	1
Total	14

*One patient in this group was operated upon elsewhere, proved to be diverticulitis and carcinoma.

The predominating symptoms were those changes in stool habits which are usually associated with varying degrees of large bowel obstruction. In 8 patients bleeding had been observed. One patient had repeated hemorrhages with transfusion. This patient has had repeated roentgenologic studies after barium enemas, only a diffuse diverticulosis being demonstrated.

In 16 patients surgery was employed. Fifteen of the patients were operated upon by the essayist. The other patient in whom a diagnosis of diverticulitis and carcinoma had been made was operated upon at The Ochsner Clinic. The pathological report confirmed this diagnosis.

TABLE 2
Surgical Procedures Performed

Procedure	Cases	Deaths
Exploration—acute cecal diverticulum, frozen sections, inversion, appendectomy	1	0
Primary resection, sigmoid, end to end anastomosis, cecostomy	8	0
Primary exteriorization, acute perforation, subsequently closed and placed below the fascia.....	1	0
Primary resection of distal half of transverse colon and splenic flexure, end to end anastomosis, cecostomy...	1	0
Primary resection, sigmoid, end to end anastomosis, transverse colostomy	2	0
Primary resection, distal third transverse colon, splenic flexure and descending colon, end to end anastomosis, cecostomy.....	1	0
Exploration of sigmoid to rule out neoplasm.....	1	0
Total	15	0

The presence of carcinoma was suspected in 11 of 12 patients undergoing resection. The lumen through the constricted area, in the other patient, was 6 mm. with a previous diagnosis of diverticulosis and a long standing history of repeated attacks of acute diverticulitis. In only 5 of the 12 patients were diverticula demonstrated by roentgenologic studies after barium enemas.

All patients in this group received adequate preoperative preparation, including succinylsulfathiazole (sulfasuxidine). The resected segments varied from 12 to 31 cm. in length. The average length of the resected segments for the group was 19.5 cm. Carcinoma was found in only one specimen. A partial disruption of the abdominal wall occurred in 1 patient. Secondary closure was made with subsequent solid union. There was no clinical evidence of complications in the remainder of the patients.

One patient with a diagnosis of diverticulosis and carcinoma, was explored. It was obvious that no obstruction existed, but the presence of a tumor could not be excluded. New growth was ruled out by exploration of the sigmoid. Recovery was uncomplicated and the patient has remained well for five years. Two patients were operated upon as emergencies, 1 as acute appendicitis, which proved to be a solitary cecal diverticulum. The other patient had a rupture of a diverticulum in the sigmoid.

There were no hospital deaths in this series. All of the patients have remained well except 2 patients who died at the age of 68 and 82 years, due to unrelated causes.

CONCLUSIONS

1. Diverticulitis is primarily a medical disease, surgery being indicated in those patients with diverticulitis who develop complications.
2. Surgical consideration should be given to those patients who have recurrent attacks of acute diverticulitis notwithstanding medical treatment.
3. Acute diverticulitis of the sigmoid colon can mimic pelvic inflammatory disease in the female.
4. Acute diverticulitis of the right colon may well simulate acute appendicitis.
5. It is not always possible to differentiate carcinoma from diverticulitis by roentgenologic studies, nor is it possible to make such differentiation with the bowel under direct vision.
6. In the absence of complete obstruction with adequate pre-operative preparation, chemotherapy and antibiotics, resection, with end-to-end anastomosis and proximal vent, should be a relatively safe procedure.

REFERENCES

1. Pemberton, J. deJ., Black, B. M., and Maino, C. R.: Progress in surgical management of diverticulitis of sigmoid colon, *Surg., Gynec. & Obst.* 85:523 (Oct.) 1947.
2. Mayo, C. W., and Blunt, C. P.: Symposium on abdominal surgery; surgical management of complications of diverticulitis of large intestine; analysis of 202 cases, *S. Clin. North America* 30:1005 (Aug.) 1950.
3. Smithwick, R. H.: Experiences with surgical management of diverticulitis of sigmoid, *Ann. Surg.* 115:969 (June) 1942.
4. Colcock, B. P.: Surgical treatment of diverticulitis, *S. Clin. North America* 30:911 (June) 1950.
5. Neal, J. W., Jr.: Diverticulitis of colon and its surgical management, *Surgery* 30:606 (Oct.) 1951.
6. Mayo, C. W., and Blunt, C. P.: Vesicosigmoidal fistulas complicating diverticulitis, *Surg., Gynec. & Obst.* 91:612 (Nov.) 1950.
7. Donald, J. M.: Surgical management of diverticulitis of colon, *Ann. Surg.* 133:708 (May) 1951.

DIAGNOSIS AND TREATMENT OF CERTAIN FORMS OF CHRONIC CYSTIC MASTITIS (BREAST DYSPLASIA)

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MAMMARY dysplasia is neither inflammatory nor neoplastic, but represents an expression of endocrine dysfunction in menstruating women.

In experimental animals estrogenic hormones have been found to stimulate the growth of the breast duct system and the formation of lobular buds. Lobule formation in the human breast is not found in the normal male and does not occur in the normal female prior to puberty (advent of the corpus luteum). Corpus luteum hormone (progesterone) acting in conjunction with the follicle hormone (estrogen) appears to be closely associated with the growth of mammary lobules during the premenstruum in cyclic women. Lobule formation is proportional to the intensity of the hormonal stimuli. Imbalance between these two hormonal activities of the ovary appears to result in irregular lobule formation such as is seen in chronic cystic mastitis. Luteal hormones of placental origin and, perhaps, a mammogenic hormone are the most effective stimulants to lobule alveolar formation. Experimental work indicates that an intact hypophysis is essential to the physiologic response brought about by the ovarian hormones and, under certain conditions, the functional activity of the anterior pituitary hormone initiates secretion in the mammary alveoli. Speert and Geschickter have observed direct effects of estrogen on breast development by applying the hormone percutaneously over one breast only, in several monkeys and in human females.

In brief, the lobular buds proliferate during estrogenic stimulation; differentiate under the influence of luteal hormones; and secrete in response to lactogenic hormone of the anterior hypophysis. Periductal connective tissue is stimulated to growth during the estrogenic phase of development. In the luteal phase, the intra-lobular stroma is greatly compressed or resorbed, but vascularity is greatly increased.

The forms of mammary dysplasia known as chronic cystic mastitis are intimately related to the physiology of lobule formation in the human breast and to the function of the corpus luteum. Lo-

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bule formation which appears defective is stimulated to normal growth, to some extent, by injections of progesterone.

The synthetic androgenic hormone, testosterone propionate, resembles progesterone in its action on the mammary glands of monkeys and rats but, to a lesser extent if at all, in the human (Geschickter). The adrenal cortical hormone must also be included among the endocrine regulators of mammary physiology, probably due to androgenic and estrogenic substances occurring in the adrenal cortex.

The nature of mammary dysplasia as described above has not gone unchallenged. Taylor and Friedman and others in independent studies conclude that dysplasia is related to ovarian dysfunction in some cases, but they think that this condition must be referred to a variety of factors, among which the nervous disturbances depending mainly on pelvic disorders are prominent. Ewing, from a review of the literature and from his own observations, concludes that mammary dysplasia (chronic cystic mastitis) has notably a hereditary character, the main etiologic factor residing in the intrinsic character of the breast itself, influenced more or less by hormonal, nervous and local conditions.

Bucher and Geschickter, however, have followed patients intensively by doing endocrine assays on total collections of the daily urine through one or more menstrual cycles. Both estrogen and pregnandiol (an index of corpus luteum function) were assayed. The results of these studies, together with the results of experimental studies by Geschickter and others on the production of mammary dysplasia, mammary neoplasia and cancer resulting from prolonged overstimulation with estrogen, strongly support ovarian dysfunction as a principal cause.

Estrogen in varying doses combined with other hormones which produce lobule formation appears to produce, experimentally, changes in animals simulating the various changes seen in chronic cystic mastitis.

Many observers support a definite endocrine factor as being linked with mammary dysplasia, benign mammary neoplasia and the production of carcinoma of the breast.

TABLE I
Mammary Dysplasia

1. Mastodynia—painful mammary tissue
2. Adenosis—Schimmelbusch's disease
3. Cystic disease—blue-domed cyst of Bloodgood

It is the purpose of the author to discuss the diagnosis and treatment of the forms of mammary dysplasia.

Mastodynia. Mastodynia is characterized by pain and tenderness in the premenstruum, referred to a portion of the breast (frequently the outer and upper third) which is more tender, firmer, thicker and more granular than the surrounding breast tissue. It may be either unilateral or bilateral. In spite of its frequency, the clinical and pathological features of this condition have remained ill-defined. It is common between the ages of 20 and 40 years and affects married women more often than unmarried, in a ratio of 3 to 1.

The patients fall into two endocrine groups:

1. Women in the childbearing age who have a tendency to sterility, or who have not recently had a pregnancy. The breasts are usually well developed, the menstrual history is normal and the disturbance in the breast comes late after maturity. The manifestations are frequently transient.

2. Young, childless women with small, atrophic breasts. Such breasts suggest a primary mammary deficiency arising at, or shortly after, adolescence. The menses are irregular and the women are frequently sterile.

Pain is an outstanding symptom and is referred to a tender lesion in one or both breasts. It is usually premenstrual and mild in character at the beginning. It ultimately becomes more severe and prolonged, finally lasting for the greater part of the entire menstrual cycle. In severe cases it keeps the patient awake at night and may radiate down the arm or over the shoulder on the affected side. Movement of the arm may aggravate the pain. The weight of excessively heavy breasts may contribute to the discomfort. Fear of cancer is often aroused in the individual.

A "lump" or swelling is related to the tender region of the breast in approximately one-half of the cases. The swelling may vary in size, being larger before and smaller after the menstrual period. The lump and symptoms may disappear for a period of time and then recur, appearing in other areas of the same or opposite breast.

On examination, the painful tissue resembles the "caked" area in acute mastitis. The most common finding is an elevated zone with a flat, granular surface, occupying the outer and upper quadrant of the breast. One or more margins of the tender tissue may be felt as a distinct and abnormal increase in thickness. Demarcation from the surrounding breast is usually indistinct. In addition, an indefinite nodular area may be palpated. The portions of the

breast involved in their order of frequency are: (a) the region of the upper and outer quadrant; (b) the mid-upper zone; (c) the mid-lower zone, and (d) the central zone.

The majority of cases of painful breast observed by us have not been subjected to operation (350 cases). However, 64 patients studied by Geschickter, from an earlier collection of material, were subjected to excisions and 29 to amputation of the affected breast. This material afforded opportunity for a study of the affected tissue. In the gross, the breast tissue was not encapsulated, was white and more fibrous in appearance than the surrounding normal structure, and small cysts were occasionally present. Histologically, imperfect lobule formation and an increase in periductal and intralobular stroma were noted. Irregular epithelial growth was seen in the terminal tubules, some of which were dilated. The lining cells of the tubules in areas were reduplicated, resembling early adenosis of the breast. Increase in the connective tissue was a constant finding. The fibrosis frequently compressed and, occasionally, completely obliterated the mammary lobules, forming minute non-encapsulated, fibro-adenomatous-like masses.

The defective lobule formation, as demonstrated in recent experimental studies, appears to be due to reduced functional activity of the corpus luteum. In some patients a relative lowering of the corpus luteum function is noted, while in others there is a definite increase in the estrogenic hormone, bringing about a relative corpus luteum deficiency.

The largest group of patients with painful breasts usually have a self-limited disease. After a period of several years, during which time the condition is manifest, there is intermittent disappearance and reappearance of the painful "lump." These indurated areas tend to disappear after pregnancy or after the menopause.

In painful breasts associated with mammary deficiency (younger age group), where no treatment has been instituted, many of the cases are unimproved after a period of from 3 to 10 years. The condition is persistent and these patients are more prone to develop Schimmelbusch's disease of the breast.

Treatment. The treatment of mastodynia is varied. Once the diagnosis of cancer or true infection has been ruled out, simple supportive measures are worthwhile, such as reassurance and a breast support (brassiere).

It is important to remember that worry, fear of cancer, and anxiety states accentuate symptoms referable to the breast and may be a factor in causing an endocrine derangement of the patient.

We have observed that a substantial number of patients have been relieved of their symptoms through persistent efforts in carrying out psychotherapy, giving reassurance, mild sedatives and encouragement, through frequent follow-ups. Endocrine therapy has not been used in this group of patients.

The treatment of mastodynia by estrogen therapy has been successful in persistent cases. It is given in doses of 10,000 international units, intramuscularly, once a week between two menstrual periods; and then 2,000 units, once a month, in the premenstruum, for a limited time. While such treatment is largely empirical, the most logical explanation has been advanced by Astwood. He has demonstrated both in animals and in humans that the administration of estrogen during the latter part of the menstrual cycle may prolong the life of the corpus luteum and thus increase luteal function which offsets the effects of estrogen.

Testosterone propionate has been used by Geschickter and myself in a selected group of patients and the results were found to be satisfactory if the treatment was maintained for several months. Testosterone was given in doses of 25 mg., twice weekly. The method has not been used routinely because of the masculinizing effects which are likely to occur with prolonged doses of the drug.

Progesterone therapy has proved the treatment of choice. The hormone is administered in oil, intramuscularly, in doses of from 10 to 20 mg., twice weekly, for the last two weeks in one or two consecutive menstrual cycles. The total dose varies from 40 to 80 mg.

Adenosis. Schimmelbusch's disease is more frequently observed in women between the ages of 35 and 44 years. It is characterized by the occurrence of multiple nodules in one or both breasts. These nodules vary from 1 mm. to 1 cm. in diameter and are usually distributed about the outer and upper hemisphere of the breast. In one-third of the patients, pain is a conspicuous feature. The majority of the women affected are childless and show evidence of nervous tension, underweight, and have a tendency to irregular menstrual cycles. The disease is often superimposed on a persistent mastodynia, usually of the deficiency type and, if so, is much more chronic and more intractable to treatment.

As in mastodynia, the breasts of a patient with adenosis are thickened, granular and tender. In two-thirds of such cases, the patient is aware of a distinct nodule or a thickened area in the breast; while pain is a conspicuous feature in approximately one-third of the patients. Exacerbation of pain and a nodule of fluc-

tuating size are common findings during the premenstruum. Many breasts contain multiple nodules and an edge can be palpated at the periphery of the diseased portion. This "caking" or induration may at times suggest the presence of cancer.

Adenosis is seen most frequently in breasts of moderate or small size. The adipose tissue is diminished in amount. A noticeable difference in the size of the two breasts is common. Tenderness of the breast parenchyma is observed on deep palpation. The bleeding nipple occurs about as often in benign conditions of the breast as in malignant conditions. In Schimmelbusch's disease, 4 per cent of the cases have bleeding nipples which are associated with intraductal papillomas, usually situated in the periphery of the breast.

The pathologic process may be limited or diffuse throughout the breast or breasts. Increased fibrous tissue is apparent and the breast is cut with difficulty. The parenchyma is riddled with cysts, minute adenomas and intracystic papillomas. Many large, dilated ducts may be found.

The growth of the hyperplastic epithelium within the lumen of tubules somewhat resembles comedo or duct cancer and the epithelial proliferation ramifying from the ends of the tubules into the surrounding stroma simulate the invasive character of alveolar cancer. Frequently this hyperplasia of atypical lobules is more apparent than real.

The differential diagnosis between carcinoma and adenosis is of the utmost importance and properly prepared microscopic sections are essential. The distinction between certain forms of breast cancer and adenosis may present unusual difficulty because of the gradations which may be found between the two diseases in certain cases.

There is a definite relation between adenosis, mastodynia and cystic disease of the breast. Tissue excised from a patient's breast with adenosis may show cysts, while that excised from a breast with cystic disease may show adenosis.

Patients with adenosis fall into two endocrine groups:

1. Women with early sexual maturity, having small breasts and changes probably due to stunting from high estrogenic stimulation in adolescence. They may have a relatively far advanced stage of the disease in their early twenties.
2. Women of 30 years or more of age with characteristic breast changes, of one or more years' duration, complaining of pain or menstrual disturbances, and who are usually psychically upset. In

this second group the symptoms and findings are apparently due to a prolonged, moderate hyperestrinism, brought about by lowered function of the corpus luteum over a long period of time. The secretion of estrogen is usually found to be within normal limits.

While the changes seen in adenosis are not essential to the development of mammary cancer, they do represent changes brought about by absolute or relative hyperestrinism. Such changes have been observed in the breasts of a definite percentage of animals undergoing estrogen therapy experimentally, and in which cancer of the breast has developed. Clinically, patients with adenosis of the breast, who have been carefully followed, show an incidence of cancer of approximately 4 per cent, as compared with an incidence of 0.42 per cent among women of the cross-section of the population.

Treatment. The therapy of adenosis (Schimmelbusch's disease) must be based upon an accurate appraisal of the condition. Investigation of all doubtful nodules is necessary. Nodules which are distinct and larger than usual, or growing noticeably larger, must be excised, whether the nodule is cystic or solid.

Amputation of a breast with Schimmelbusch's disease to prevent possible development of cancer is not justified. On the other hand, biopsy specimens which are difficult for pathologic interpretation, or which show early cancer, leave no recourse to the physician except that of doing a radical mastectomy.

Estrogenic therapy is not satisfactory in adenosis. Patients with this condition already have a relative or absolute hyperestrinism of long standing which, in animal experimentation, leads to the development of cancer. It is, therefore, not considered coincidental that there is an increased incidence of cancer among patients with adenosis of the breast.

Progesterone or testosterone therapy has given symptomatic relief in many of the patients treated, but the small, discrete nodulations usually persist. Progesterone in oil is administered in from 10 to 20 mg. doses, intramuscularly, in the last two weeks of two to three menstrual cycles. Recurrence of pain may be encountered at various intervals after the administration of the drug. Periods of quiescence have been noted up to two or more years. If the nodulations are cystic, aspiration may be indicated to obliterate them.

In patients followed during pregnancy and lactation, disappearance of the nodularity and tenderness occurs after mid-pregnancy and the breasts are normal during lactation. In a number of such

patients the breasts, previously the seat of adenosis, have been found negative at examination a year or more after childbirth.

Cystic Disease of the Breast. Cystic disease of the breast in the female is characterized by one or more cysts, 1 cm. or more in diameter, situated in the parenchyma of the breast structure, occurring during or near the menopause. The breasts affected usually show little or no atrophy, but contain increased amounts of fibrous or fatty tissue. A solitary cyst is the most common benign lesion in the breast during the cancer age. Its differentiation from cancer at times constitutes a difficult problem.

In an analysis of over 600 cases of cystic disease, the peak of age incidence was noted (by Geschickter) to be between the forty-first and forty-fifth years of life. Macrocystic disease usually did not occur in subjects younger than 23 years of age. Postmenopausal macrocystic disease invariably gave the history of breast disturbances prior to the menopause.

Cystic disease predominates in childless women in a ratio of 3 to 2. In women with children, cystic changes appear when the average age of the youngest child is 10 years and, rarely, when less than four years have elapsed after the last pregnancy.

Few patients with cystic disease have menstrual disorders (except menopausal syndrome) or difficulty with childbearing. Therefore, the only important etiologic factors which stand out, in a review of the histories, are the number of childless women affected, and the relatively large number of women who are approaching the menopause when the disease appears.

When assays of urine estrogen and pregnandiol (a reflection of progesterone function) were carried out on patients with macrocystic disease and linked with experiments on controlled rats receiving large injections of estrogen and small injections of progesterone, Geschickter and others found evidence to support the probability that an intense or unopposed estrogen stimulus results in the formation of cysts. The period of stimulation may be brief and the withdrawal of the stimulus followed by secretory activity may play a rôle in the development of the cysts.

The symptoms of cystic disease may appear abruptly and are often of short duration prior to the time of observation. The chief complaint is the discovery of a "lump," although 40 per cent of the patients had noticed mild pain, soreness, or a burning or a sticking sensation. Serous discharge from the nipple was occasionally observed. Fluctuation in the size of a cyst was frequently noted by the patients. Cysts may change in size and tend to disappear

in about 7 per cent of the cases. The breasts affected are usually fairly large or adipose in type. The cysts are usually found away from the periphery of the breast and, on palpation, present a smooth, rounded, tense and freely movable tumefaction. Fluctuation can be made out in some cases. If the cyst is situated deep in the breast and lies close to the chest wall, its nature and extent are difficult to appraise. Thick-walled cysts also present a problem in diagnosis.

In a large number of patients only one cyst of appreciable size is found, but single cysts may be found in both breasts in 11 per cent of the cases. Multiple cysts are found in one or both breasts in 25 per cent of affected women at the first examination, but tend to occur in a slightly younger age group who have symptoms similar to those associated with Schimmelbusch's disease. The tendency to multiplicity and bilateral involvement further suggests an underlying endocrine disturbance substantiated by experimental studies.

The tumor and breast can be transilluminated well. A majority of cysts project into the fat overlying the breast parenchyma and are easily aspirated, yielding a cloudy or serous fluid. Cysts deep in the breast, or with thick walls, are aspirated with greater difficulty.

At operation a mammary cyst is found to have a tense, thin wall, with a bluish tint. The description by Bloodgood of a blue dome, which loses its color when the cyst is opened, is a classic one. Serous or cloudy fluid is noted within the cavity of the cyst and its wall is usually smooth and glistening. A large portion of the cyst is embedded in dense, fibrous parenchyma of the breast. Involutional changes are usually present in the surrounding breast structure. Microscopically, changes are found in the lobules and ducts. The lobules are small, irregular and undergoing dilation or regression. Occasionally small foci of epithelial proliferation resembling the tissue in adenosis may be found. The lining epithelium of the cyst is often replaced by fibrous tissue. Persistent epithelium may be cuboidal or columnar with eosin-staining cytoplasm. In some of the smaller tubules or acinous structures the epithelium closely simulates sweat gland epithelium. This latter epithelium, we believe, represents a physiologic change in the tissue, rather than a true metaplasia.

Cysts with a papilloma projecting into the cavity, or with walls formed by cancerous tissue, do not appear to result from the pathologic process involved in cystic disease in the majority of cases. Intracystic papillomas and cancer cysts occur after the menopause and most frequently affect large ducts in the region of the nipples, whereas the cysts in macrocystic disease usually occur prior to or

during the menopause and affect the smaller ducts and terminal tubules. Intracystic papillomas occurring in the younger age groups are usually found associated with Schimmelbusch's disease and are situated in the periphery of the breasts.

Treatment. Spontaneous regression prior to treatment has been noticed in about 7 per cent of patients observed by us. When aspiration only is employed in treating cysts, in the majority of cases the lesions refill or additional cysts appear. In cysts treated by excision, 15 per cent of the patients develop subsequent cysts in the same or opposite breast. Among a total of 445 patients followed for more than five years, 5 have subsequently developed mammary carcinoma following an excision of a cyst elsewhere in the same organ. It would appear, therefore, that women with cystic disease who are treated by excision of the cysts and surrounding breast area remain free from further significant disorder in 85 per cent of the cases, and that in only about 1 per cent of patients with cystic disease of the breast is there a complication of cancer.

Cysts usually do not respond well to endocrine therapy. A solitary cyst, therefore, is best treated by simple excision. Amputation of one breast does not prevent the occurrence of cysts in the opposite breast, and the incidence of mammary cancer (1 per cent) does not justify bilateral amputation. If a single cyst has been previously excised and additional cysts appear, or in those cases with multiple cysts of one or both breasts, aspiration may be used to verify the cystic nature of the tumors. In such instances, careful observation and attempts to control the condition by endocrine therapy seem justifiable. In patients beyond the menopause, recurring cysts or nodules should be considered of more significance and repeated excisions, if necessary, are indicated.

SUMMARY AND DISCUSSION

Of the three forms of mammary dysplasia, mastodynia, that is simple mammary nodosity with pain, is the most common and least serious. The defective lobule formation accompanying this disorder is due to reduced function of the corpus luteum. It has been pointed out that normal lobule formation depends upon the proper ratio of estrogen and corpus luteum hormones.

Dr. Geschickter and I have followed 350 cases of mastodynia for five years and have observed only a single case of mammary carcinoma associated with this form of dysplasia. This patient had gone through a normal pregnancy 12 years prior to developing cancer, and had been free of the mastodynia since the pregnancy.

The tumor developed in aberrant breast tissue, apparently unrelated to the previous mastodynia.

The treatment of mastodynia is varied. Once the diagnosis of cancer or true infection has been ruled out, simple supportive measures are worthwhile. Psychosomatic therapy is of the utmost importance. It has been our observation that endocrine therapy is unnecessary in a large segment of patients with this disorder, if the patient is given insight into her disease and reassurance that cancer does not exist. An uplift brassiere, for patients with heavy breasts, is indicated. If endocrine therapy is utilized, progesterone therapy is the treatment of choice. Quiescent periods of two or more years have been noted after satisfactory therapy.

Cystic disease is the next most common form of mammary dysplasia. Experimental evidence supports the probability that an intense or unopposed estrogen stimulus results in the formation of cysts. The period of stimulation may be brief and the withdrawal of the stimulus, followed by secretory activity, plays a rôle in the development of the cysts.

In 445 patients with macrocystic disease, followed for five years or longer, treated by simple excision or exploration, only five instances of carcinoma ultimately occurred in this group. This agrees with the observation of Warren that carcinoma is twice the expected rate. It is still low enough, however, to make conservative procedures the treatment of choice, including aspiration of the cyst; surgical excision of the cyst; and, in selected cases, endocrine therapy.

Adenosis of the breast is, fortunately, the least common form of mammary dysplasia, since it is the most serious in many of its aspects. Throughout the breast parenchyma increased periductal and perilobular fibrous tissue, small cysts, minute adenomas, papillomas and dilated ducts are characteristic. In advanced cases intra-ductal hyperplasia and the epithelial proliferation of acini closely resemble changes seen in various forms of cancer.

While the changes seen in this disease are not essential to the development of mammary cancer, they do represent changes due to a persistent hyperestrinism which, on an experimental basis, has been found to lead to the development of breast cancer in animals. Clinically, Dr. Geschickter and I have found that among 150 patients with adenosis of the breast, who have been carefully followed, the incidence of cancer is 4 per cent, while among those with cystic disease the incidence is approximately 1 per cent. Dr. L. V. Dublin, of the Metropolitan Life Insurance Company, has calculated the probability of mammary cancer in the general female

population for this age group, during the average period of 10 years through which these cases have been followed. For women between 35 and 45 years of age the chances are from 0.28 to 0.55 per cent for the development of mammary cancer in the succeeding 10 years. The incidence of breast cancer among women as a whole is 0.42 per cent.

Therapy in adenosis consists of surgical investigation of all doubtful nodules. Biopsy specimens which show cancer indicate a radical mastectomy. Aspiration of cysts may be indicated to obliterate them. Estrogen therapy is not satisfactory and is unsafe to use. Progesterone for symptomatic relief is effective in a fair percentage of the cases. Some discomfort may persist, or the symptoms accompanying the disease may become quiescent for two or more years. The nodulations appear to be unaffected by endocrine therapy in the large majority of the patients. Pregnancy has caused a subsidence of the disease process in a number of instances.

REFERENCES

1. Adair, F. E.: Sanguineous discharge from nipple and its significance in relation to cancer of breast, *Ann. Surg.* 91:197 (Feb.) 1930.
2. Astwood, E. B., and Geschickter, C. F.: Changes in mammary gland of rat produced by various glandular preparations, *Arch. Surg.* 36:672 (April) 1938.
3. Bloodgood, J. C.: Pathology of chronic cystic mastitis of female breast, *Arch. Surg.* 3:445 (Nov.) 1921.
4. Bloodgood, J. C.: Benign tumors of breast; encapsulated adenoma, *Ann. Surg.* 79:172 (Feb.) 1924.
5. Bonser, G. M.: Effects of estrone on mammary gland of male mice, in *Second International Congress Against Cancer*, 1937, p. 53.
6. Bucher, N. L. R., and Geschickter, C. F.: Corpus luteum studies. I. Recovery of pregnandiol from urine, *Endocrinology* 27:727 (Nov.) 1940.
7. Bucher, N. L. R., and Geschickter, C. F.: Corpus luteum studies. II. Pregnanediol and estrogen output in urine of patients with chronic cystic mastitis, *J. Clin. Endocrinol.* 1:58 (Jan.) 1941.
8. Burrows, H.: Comparison of changes induced by some pure estrogenic compounds in mammae and testes of mice, *J. Path. & Bact.* 42:161 (Jan.) 1936.
9. Campbell, O. J.: Relationship between cystic diseases of breast and carcinoma, *Arch. Surg.* 28:1001 (June) 1934.
10. Copeland, M. M.: Newer aspects of benign tumors of breast, *Arch. Surg.* 55:590 (Nov.) 1947.
11. Copeland, M. M.: Benign tumors of breast and associated conditions, *South Dakota J. Med. & Pharm.* 2:116, 1948.
12. Copeland, M. M., and Geschickter, C. F.: Symposium on diagnosis and treatment of premalignant lesions of breast, *S. Clin. North America* 30:1717 (Dec.) 1950.
13. Dublin, L. V.: Mortality from Cancer; Monograph I, New York, Metropolitan Life Insurance Company, 1935.
14. Emge, L. A., and Murphy, K. M.: Influence of long-continued injections of estrogen on mammary tissue, *Am. J. Obst. & Gynec.* 36:750 (Nov.) 1938.
15. Ewing, J.: Neoplastic diseases, ed. 4, Philadelphia, W. B. Saunders Company, 1940, p. 538.
16. Frank, R. T.: Premature sexual development in children due to malignant ovarian tumors, *Am. J. Dis. Child.* 43:942 (April) 1932.

17. Friedman, M., Finkler, R., and Antopol, W.: Relation of ovarian hormones to benign breast hyperplasia and neoplasia, *Radiology* 33:725 (Dec.) 1939.
18. Gardner, W. U.: Influence of estrogenic hormones on abnormal growth, in Ward, H. B.: *Some Fundamental Aspects of the Cancer Problem*, American Association for the Advancement of Science (Supplement to v. 85 of Science) New York, The Science Press, 1937, p. 67.
19. Geschickter, C. F.: Mammary carcinoma in rat with metastasis induced by estrogen, *Science* 89:35 (Jan. 13) 1939.
20. Geschickter, C. F.: *Diseases of the Breast*, Philadelphia, J. B. Lippincott Company, 1945, chap. 2, p. 42.
21. Geschickter, C. F.: *Diseases of the Breast*, Philadelphia, J. B. Lippincott Company, 1945, p. 325.
22. Geschickter, C. F.: *Diseases of the Breast*, Philadelphia, J. B. Lippincott Company, 1945, p. 183.
23. Geschickter, C. F.; Lewis, D., and Hartman, C. G.: Tumors of breast related to estrin hormone, *Am. J. Cancer* 21:828 (Aug.) 1934.
24. Lacassagne, A.: Relationship of hormones and mammary adenocarcinoma in mouse, *Am. J. Cancer* 37:414 (Nov.) 1939.
25. (a) Lewis, D., and Geschickter, C. F.: Relation of chronic cystic mastitis to carcinoma of breast, *Surg., Gynec. & Obst.* 66:300 (Feb. no. 2A) 1938.
25. (b) Lewis, D., and Geschickter, C. F.: Endocrine therapy in chronic cystic mastitis, *J.A.M.A.* 109:1894 (Dec. 4) 1937.
26. Loeser, A. A.: Action of testosterone propionate on uterus and breast, *Lancet* 1:373 (Feb. 12) 1938.
27. MacDonald, I. G.: Response of mammary gland to prolonged stimulation with ovarian hormones, *Surg., Gynec. & Obst.* 63:138 (Aug.) 1936.
28. Nathanson, I. T.: Relation of hormones to diseases of breast, *Surgery* 16:108 (July) 1944.
29. Oliver, R. L., and Major, R. C.: Cyclomastopathy; physiopathologic conception of some benign breast tumors, with analysis of four hundred cases, *Am. J. Cancer* 21:1 (May) 1934.
30. Speert, H.: Mode of action of estrogens on mammary gland, *Science* 92:461 (Nov. 15) 1940.
31. Speert, H.: Hyperplastic mammary nodules in castrate female Rhesus monkey, *Bull. Johns Hopkins Hosp.* 67:414 (Dec.) 1940.
32. Taylor, H. C., Jr.: Evidence for endocrine factor in etiology of mammary tumors, *Am. J. Cancer* 27:525 (July) 1936.
33. Taylor, H. C., Jr.: Endocrine aspects of chronic mastitis, *Surg., Gynec. & Obst.* 74:326 (Feb. no. 2A) 1942.
34. Taylor, H. C., Jr.: Relation of chronic mastitis to certain hormones, *Surg., Gynec. & Obst.* 62:129 (Feb.) 1936.
35. Warren, S.: Relation of chronic mastitis to carcinoma of breast, *Surg., Gynec. & Obst.* 71:257, 1940.

CYST OF THE PANCREAS, FURTHER OBSERVATIONS ON TREATMENT BY INTERNAL DRAINAGE

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MALIGNANT tumors of the pancreas continue to offer insurmountable obstacles surgically, while benign lesions, chiefly cysts, are approached with far more optimism and gratifying results.

The number of reported cases of pancreatic cysts continues to grow and while few men have sizeable series of their own, the experience of dealing with this problem continues to accumulate so that one is able to glean much from others and thus draw increasingly reliable conclusions.

The purpose of this paper is to review the subject very briefly and to add 1 case of the authors' which was successfully treated by internal drainage, or the cysto-visceral procedure. For the sake of clarity this discussion will be confined to the so-called "pseudocyst," the encysted fluid collections in the lesser omental area and densely a part of the pancreatic structure. The cyst wall is usually 2 to 8 mm. in thickness and usually lacks the epithelial lining of the true pancreatic cyst.

The strange process by which the pancreas reacts to inflammation and to trauma is referred to by Meyer, Sheridan and Murphy. They believe that its anatomical location against the vertebral column, plus its outpouring of large amounts of fluid which may or may not contain enzymes, and its abundant blood supply are all factors in its cyst-producing properties.

Etiologically, the pseudo-cyst is said to be related to pancreatitis and trauma, the former much more frequently than the latter. Indeed it is not often that one is able to clearly define cases where trauma, direct or otherwise, has played a vital part in producing this condition. Definite evidence of pancreatitis, however, is frequently available, as noted by Priestly, Collins, Scott and others. The encapsulated collection of fluid, often containing necrotic fat and cellular debris strongly suggests necrotizing pancreatitis. Judd, Mattson and Mahorner have emphasized the frequency with which disease of the biliary tract has been found associated with pancreatitis and cystic degeneration, thus closely relating this process to infection.

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The rarity of this condition is evidenced by the fact that Warren in 1948 found only 16 such cases on record at the Lahey Clinic, while Meyer and his associates found 31 cases of pseudocysts at the Northwestern University Medical School and Cook County Hospital. Three cases have been found at Emory University and Grady Memorial Hospitals in Atlanta. Out of 209,000 admissions to the Presbyterian Hospital in Hollywood, California, 9 cases were found, an incidence of .004 per cent. In our two general hospitals in Lexington, representing over 600 beds, we were able to locate only 4 such cases.

The incidence of this condition as regards the sexes seems to be about equal. The most common age at which the diagnosis was made was between 30 and 60 years. Meyer and his associates, reporting 31 cases treated between 1930-1947 inclusive, at the Cook County Hospital, found 2 under 20 and 2 over 60 years of age. Brillhart and Priestly, reporting 41 cases, found an average age of 46.4 years.

Pain as the predominant symptom occurred in over 85 per cent of cases reported. Here the character and location of the pain is such as to require hypodermic medication. The location is usually epigastric but may be in either the right or left upper quadrant and commonly extends through to the back. Dyspepsia, associated with excessive gas and bloating, was a frequent symptom.

A palpable mass was present in the great majority of cases reported. Without this mass the preoperative diagnosis becomes even more questionable. The size of the cyst may vary from a few cm. to 30 cm. or more and is commonly described as the size of an orange or grapefruit, and may contain 3 or 4 litres of fluid. Its wall is thickened and surrounded by dense, inflammatory adhesions. Its fluid content is usually turbid with a thin syrup-like consistency. It may be milky or even bloody. A positive culture was obtained only once in seven studies reported by one writer.

In competent hands, the roentgenologic studies of these cases are frequently quite helpful. The barium meal often reveals a displaced stomach and scout roentgenograms of the abdomen may show evidence of a radio-opaque mass. A barium enema will usually show some transverse colon displacement.

Laboratory data in uncomplicated cases frequently are of little significance. Glycosuria is usually not present while the serum amylase is usually a high normal.

The surgical treatment of this lesion may be:

1. Excision.

2. Marsupialization.

3. Internal drainage or cysto-visceral anastomosis.

Although excision is generally considered the most difficult and hazardous, technically, it is frequently referred to as the "ideal treatment." Lahey reports 9 to 25 per cent mortality, if excision is successful, and up to 55 per cent if excision is unsuccessful. There is little evidence to support the statement that excision is the procedure of choice.

Marsupialization appears to be the procedure most commonly adopted in recent years. In Bilhard and Priestly's series, this method was followed in 12 cases, while various other methods were done in the remaining 32 cases. In their 31 cases reported, Meyer and his associates marsupialized 21, with only one death. In addition they were able to completely excise the cyst in two instances, without a mortality. Adams and associates report 9 cases with 2 treated by marsupialization, 4 by internal drainage, 2 by excision and 1 by incision and drainage.

The term internal or cysto-visceral drainage as applied to the treatment of pancreatic cyst may be:

1. Transgastro pancreato-cystogastrostomy, so well described by Scovel and Holliger and given as their procedure of choice.

2. It may be a cystocholecystostomy, an operation made preferable by virtue of the location of the cyst with relation to the gall-bladder and reported by various writers with reasonably good results.

3. It may be the cystojejunostomy of the simple variety of the much more technically difficult Roux-Y type of anastomosis as first described and successfully performed on pancreatic cyst by Gurwitz and Hurwitz in 1947.

It is the simple cystojejunostomy which we wish to present as a relatively simple and safe procedure. Of the 4 cases collected from our two local general hospitals (1 case of Dr. W. H. Pennington and 1 of Dr. W. D. Barrow), 2 were treated by incision and drainage and required further surgery elsewhere; 1 treated successfully by marsupialization and 1 successfully by cystojejunostomy.

In each case a painful epigastric mass was the chief symptom. Three were women, one was a man. The ages varied from 22 to 40 years. In one the preoperative roentgenologic diagnosis was cholecystitis with stones. This was verified at operation. A cyst of the pancreas was also found, incised and drained. She had a very stormy course and later required further surgery.

In another case the preoperative roentgenogram was interpreted as consistent with cancer in the head of the pancreas. In this case the cyst was successfully marsupialized.

Our case was a 22 year old married college student. She consulted her physician because of a mass in the upper left quadrant of the abdomen which seemed to be attached to the rib margin. She was a very healthy looking, moderately obese young woman, who had enjoyed good health all her life. She was married two years previously and in her efforts to reduce she and her husband had been taking vigorous exercises, including heavy weight bearing on her belly muscles. She thought she might have bruised herself at such times. She had not had digestive disturbances. The usual blood and urine laboratory studies were within normal limits. On Jan. 31, 1950 the colon roentgenogram showed no organic pathology. Four days later roentgenograms of the stomach showed evidence of extrinsic pressure along the greater curvature, pushing it upward and slightly anterior. A mass appeared to be in the left upper quadrant in the region of the kidney. Four days later, an intravenous pyelogram outlined a normal-appearing kidney.

The patient was admitted to the Good Samaritan Hospital and on Feb. 16 the left upper abdomen was explored. A mass the size of a grapefruit was found behind and to the left of the stomach, pushing it forward. There were dense adhesions over its surface and complete excision appeared to be an extremely difficult as well as hazardous undertaking. The lower anterior surface of the rounded mass was exposed and packed off. A large trocar, under suction, was introduced and approximately 800 cc. of turbid fluid was withdrawn. As soon as this was accomplished the thickened wall collapsed, thus lending itself more readily to anastomosis with a loop of jejunum. The opening into the cyst was enlarged to 3 cm. and to this was attached a loop of jejunum, in the conventional manner, using fine silk throughout. Thus with an adequate stoma and without infringing upon the lumen of the bowel, permanent dependent drainage was established. One Penrose drain was placed down to the area and this was removed on the sixth postoperative day. She left the hospital on her tenth postoperative day. The wound was soundly healed. Since then she has had two full-term, normal pregnancies and has been entirely symptom free, so far as the cyst was concerned.

On Jan. 28, 1952 roentgenologic examination by barium meal was reported as follows: "The esophagus, stomach and duodenal bulb are negative. There is a 5 cm. segment of the second portion of the duodenum which shows some narrowing and a loss of normal

mucosal pattern, compatible with adhesions from previous surgery. The soft tissue mass previously described cannot be identified on these roentgenograms. The jejunum appears to be normal." Physical examination on the same day revealed no abdominal abnormalities.

The chief objection which has been raised regarding this so-called internal drainage procedure is that the anastomosed cyst forms a pocket which lends itself to contamination and infection. There is little evidence to support this contention. If the drainage point is established at a dependent area, no reflux is likely, nor has any such complication been reported. Some writers do not consider the procedure curative since it does not obliterate the cavity. From the cases reported and the experience at hand it appears that when a cyst is drained it collapses and apparently obliterates itself. Even if secretion continues, its bowel, stomach or gallbladder connection as the case may be seems quite adequate to accommodate the secretion.

We are of the opinion that the operation of choice in dealing with pseudocyst of the pancreas is internal drainage, by cystojejunostomy. In the majority of cases it is far less hazardous than total excision and it offers a practical and physiologically effective means of cure.

REFERENCES

1. Adams, R., and Nishijima, R. A.: Surgical treatment of small cysts, *Surg., Gynec. & Obst.* 83:181-187 (Aug.) 1946.
2. Brillhard, K. B., and Priestly, J. T.: Pseudocysts of the pancreas, *Am. J. Surg.* 81:151 (Feb.) 1951.
3. Carter, R. F., and Slaterry, L. R.: Factors influencing management of pancreatic cyst, *S. Clin. North America* 27:411-416 (April) 1947.
4. Collins, D. C.: Pseudocysts of pancreas: total excision; report of case, *Arch. Surg.* 61:524 (Sept.) 1950.
5. Gurwitz, J., and Hurwitz, A.: Treatment of pancreatic cyst, *Ann. Surg.* 128:976-980 (Nov.) 1948.
6. Johnson, T. A., and Lee, W. E.: Symposium on new trends in surgery; pancreatic cyst, report of 5 cases, *S. Clin. North America* 22 (Dec.) 1942.
7. Jones, E. S.: Pancreatic cysts, with report of 2 unusual cases, *J. Indiana M. A.* 37:175 (April) 1944.
8. Meyer, K. A., Sheridan, A. I., and Murphy, R. F.: Pseudocysts of pancreas, *Surg., Gynec. & Obst.* 88:219 (Feb.) 1949.
9. Rabinovitch, J., and Pines, B.: Cyst of pancreas, *Arch. Surg.* 45:727-746 (Nov.) 1942.
10. Rosi, P. A.: Internal drainage of pancreatic cyst by means of a Roux-Y anastomosis the jejunum, *A.M.A. Arch. Surg.* 63:119 (July) 1951.
11. Scott, J. V.: Pancreatic cyst, *Arch. Surg.* 59:1304-1318 (Dec.) 1949.
12. Scovel, R. E., and Holliger, V. H.: Transgastric pancreaticocystogastrostomy, *J. Internat. Coll. Surgeons* 13:278 (March) 1950.

THE DISCHARGING NIPPLE—ITS RELATION TO BREAST CANCER

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THE discharging nipple is obviously not a clinical entity, but is simply evidence of either physiologic or pathologic breast changes. Disregarding the physiologic discharge associated with lactation, practically all other discharges are indicative of abnormal changes in the breast. By and large, our primary clinical interest in breast lesions is the early detection and treatment of breast cancer. Many benign lesions are treated by surgery principally to be certain they are not malignant.

There is a great deal of confusion about breast discharges: part of this is due to some reports concerning only bloody discharges, others including all types. Differences of opinion regarding the significance of discharges vary widely. Bloodgood³ wrote: "Discharge from the nipple, like pain, is not an indication of a lesion of the breast for which operation is indicated." Confining his opinion to only bloody discharges, Koechlin²² says: "Bleeding nipples are caused by one or more intraductal papillomas which are the most dangerous forms of mastopathies. . . . This disease must be operated on early, as soon as the patient perceives a slight bleeding from the nipple." Stowers²⁹ recommended mastectomy in all cases of bleeding nipples, but Bartlett² says: "Bleeding is a positive sign of benignancy and the treatment is always local." Adair¹ states, "There are few clinical problems which present such a wide divergence of opinion as the subject of the bleeding nipple."

In 1946, Campbell⁴ wrote: "The small number of articles in the American literature of the past 10 years dealing with bloody discharge from the nipple suggests a general acceptance of the significance of this symptom and no challenge to the therapeutic measures recommended." In 1951, Lewisohn and Chambers²⁴ commented that "The significance of nipple discharge lies in the insignificance with which it is regarded." However, there have been enough studies reported to permit a reasonably accurate answer to two questions: (1) How many proved breast cancers have discharging nipples as a presenting symptom or sign? (2) How many breasts with discharging nipples have or subsequently develop cancer?

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Frequency of Nipple Discharges: Aside from lactation phenomena, a discharging nipple is not too common a finding. Garland¹⁰ found it in 7.7 per cent of 207 cases in private practice, Fitts, et al,⁹ reported it in 8.3 per cent of 1051 cases, Donnelly⁸ in 9.6 per cent of 2269, Hinchey²⁰ in 8.3 per cent of 1051, and Lewisohn and Chambers²⁴ in 5.2 per cent of 2195. Here again there is considerable source of confusion as to what type of discharge is being considered. Geschickter¹¹ says 2.4 per cent of all adult women have a discharge, Garland (quoted by Geschickter) says 46 per cent of parous women a year or more after weaning, have so-called nonpuerperal secretion. Twenty per cent of women at the menopause and 66 per cent recently castrated women (Grunbaum) also have such a secretion due to decline in ovarian function.

In 420 cases of nonlactating breast lesions seen at the Tumor Clinic of Shreveport Charity Hospital in the eight year period from 1943 to 1951, inclusive, there were 72 cases of discharging nipples, an incidence of 17 per cent. This higher per cent may be due to the fact that all types of nonlactating discharges are included, or to the fact that practically all breasts referred to the clinic have some obvious disease.

Types of Discharges: The type of discharge is not necessarily indicative of the underlying disease. Lewisohn and Chambers²⁴ in their recent report found a haphazard relationship between the type of nipple discharge and underlying pathology, except in cases of papillomas. They found these to show serous or serosanguineous discharge. Garland's¹⁰ statement, "A dribbling nipple may tell what is going on within the breast," is more droll than accurate, for no type of discharge is specific for a particular disease.

Years ago (1923) Miller and Lewis (quoted by Adair¹) had this to say about the relationship of type of discharge and the disease causing it: "A thin serous or blood-stained discharge is regarded as indicative of an intraductal papilloma; a frank bloody discharge of carcinoma and a mucoid or dark colored discharge of chronic mastitis." Whether these generalities are supported by subsequent studies is difficult to determine, as relatively little stress has been placed on the variations or types of bloody discharge. Table I shows the types of discharge found in the various conditions in our group of 72 cases.

Causes of Nipple Discharges: These may be divided into four general classes:

1. Endocrine imbalance. This would include not only lactation

phenomena but discharge seen in nonpuerperal secretion, presumably caused by failing ovarian function.

2. Duct Stasis, or ectasia, including such lesions as Bloodgood's varicocele tumor.

3. Infection.

4. Neoplasms, benign and malignant.

Table I lists the causes of nipple discharge in our 72 cases.

How often does cancer of the breast have the finding of a discharging nipple? The studies of Geschickter¹¹ are most informative regarding this. He quotes Prass as reporting an incidence of 0.15 per cent, Wolpers an incidence of 1 per cent, while Geschickter himself in a group of 2393 cases found 4 per cent with a bloody nipple discharge. In 212 cases of breast carcinoma seen at the Tumor Clinic during the eight year period, which were reviewed by us, we found 25 instances of nipple discharge of all types, an incidence of 11.8 per cent. But the type of malignancy has a bearing on the frequency of a discharging nipple. In general, Geschickter found the incidence of sanguineous or serosanguineous discharge low (1.9 per cent) in scirrhus cancer and higher (14 per cent) in more highly differentiated tumors. Percentages varied from 20 per cent in duct carcinoma, and 36 per cent in comedo carcinomas to 10 per cent in gelatinous carcinoma. It is evident that when we speak of the frequency of a discharging nipple as a finding in cancer, it varies considerably with the type of lesion. More significant is Geschickter's finding that, whereas bleeding preceded a detectable tumor in 22 per cent of breast cancers, in 94 per cent of the cases the bleeding was neglected by the patient until there was a detectable tumor present. The public is apparently not as aware of the dangers of nipple discharge as of tumor formation.

How often is nipple discharge an evidence of malignancy? In some 5377 breast lesions, Geschickter¹¹ found 6.3 per cent of benign lesions to have a bloody discharge and 4 per cent of malignant lesions to bleed. As he says: "This study indicates that a sanguineous discharge from the nipple is more frequent in benign than in malignant lesions and is rarely a symptom of onset in infiltrating or scirrhus mammary cancer."

Apparently there are considerable differences in reported statistics as to the relative frequency of association of nipple discharges with benign and malignant lesions. Thus Adair,¹ in 1930 reported that in 108 cases, 42 per cent were due to malignant causes, 58 per cent to benign lesions. Campbell⁴ reports that in 55 instances of nipple discharge 38 per cent were due to cancer, 62 per cent to benign

TABLE I
Correlation Between Type of Discharge and Pathology
Total Number of Cases: 72

Diagnosis	Serous	Serosanguineous	Bloody	Brownish	Whitish	Brownish Green	Total No. Cases
Chronic cystic mastitis	7		8		7	1	23
Lipoma			1				1
Fibroadenoma	1	1	2		1		5
Intraductal papilloma	1	1	7	5			14
Abscess	1		2		1		4
Carcinoma	4	5	13		3		25
Total	14	7	33	5	12	1	72

TABLE II
Relative Frequency of Malignancy and Benignancy
In 72 Cases of Nipple Discharge

	No. of Cases	Per Cent
Carcinoma	25	35
Benign Lesions	47	65

conditions. Donnelly⁸ found in 219 cases that the discharge was associated with cancer in 45 per cent, with benignancy in 55 per cent. Fitts, et al,⁹ found the relative frequency of causes to be: cancer 25 per cent, benign 75 per cent, and Lewisohn and Chambers,²⁴ cancer 20 per cent and benign 80 per cent. Table II shows causes that in 72 cases of discharging nipple, 25 or 35 per cent were due to carcinoma and 47 or 65 per cent were associated with benign lesions. Mathews²⁷ thinks quite strongly that the danger of a bloody discharge being associated with malignancy has been over emphasized in the past. But he emphasizes that since a significant number are associated with cancer, all must be investigated.

Once there is evidence of nipple discharge, particularly if it is unilateral, and also particularly if it is serous, sanguineous or sero-sanguineous, the burden of proof rests with the surgeon to eliminate cancer as a cause.

The Management (Diagnosis and Treatment) of Breasts with Nipple Discharge: There are several additional points of information which may guide us in the management of these cases.

1. The association of pregnancy or evidence of failing ovarian function.
2. The character of the discharge.
3. The presence or absence of a palpable tumor.
4. The evidence of opacity or opacities on transillumination.
5. The localization of the source of discharge by the "rotating compression test."

All of these factors must be considered together in deciding whether the discharge is one that can be safely watched or whether some type of surgery for definite diagnosis is indicated.

Lactation or the so-called nonpuerperal secretions rarely cause concern. In the absence of a definite tumor they may well be ignored. But if a definite tumor is present, it must be excised for diagnosis. The extreme seriousness of cancer in the lactating breast is well known. Haagensen¹⁴ originally included such a cancer in his group of categorically inoperable. But since Harrington¹⁷ at the Mayo Clinic has shown it possible to salvage even a few such cases, it is imperative that all breast tumors occurring in the lactating breast be removed for diagnosis and further treatment.

Since any type of discharge, as well as a bloody one, can occur in cancer, it is doubtful if much practical value derives from studying the secretion. The presence of pus may indicate an infectious origin,

but whether there is or is not blood in the secretion, it requires further investigation. Mathews²⁷ informs us that he considers the study of the secretion for tumor cells to be of little value, as it is infrequently positive, and a negative test is of no diagnostic import.

The single most valuable guide is the presence of a palpable tumor. Those tumors responsible for the nipple discharge are almost invariably subareolar in location. While in the majority of cases they will be papillomatous growths, the incidence of malignancy is high enough to make it mandatory to remove such tumors for diagnosis (and cure of the discharge). Table III shows the frequency with which we found a palpable tumor in our cases.

It is in the presence of a discharge (particularly sanguineous or serosanguineous) and the absence of a palpable tumor that most confusion arises as to proper management. Here the procedure of transillumination as suggested by Cutler⁵ years ago is particularly of value. Any shadow-producing lesion, even though not palpable as a tumor, should likewise be excised. We have used Hicken's^{18,19} mammography occasionally but have thought it was not too valuable as a guide to correct management and is hardly worth the time, effort and discomfort to the patient.

What about the cases of nipple discharge in which no tumor is palpable and no opacities are visible on transillumination? Here the procedure of "rotating manual compression" is invaluable. It consists of compressing each area of the breast to locate the quadrant from which the secretion is coming. Usually this is easily done. A quadrant resection is done and the specimen studied. Such an operation results in a relatively normal breast and is well accepted. In all cases, if the lesion is benign, no further treatment is needed. If it is malignant and there are no contraindications, the radical amputation is subsequently carried out.

It is the case in which there is a discharge (particularly if it is bloody), in which no tumor can be felt, no opacity is demonstrable, and in which the discharge seems to come from several ducts or several areas of the breast that causes us most concern. In most instances such a discharge is from multiple duct papillomas. There seems to be no doubt that such duct papillomas can become malignant, though rarely so.^{11,13,15,27} Therefore, such multiple duct papillomas must be considered precancerous, even though this is apparently of infrequent occurrence. This is the possible justification for Stowers²⁰ recommending mastectomy in all cases of bleeding. But since mastectomy, especially in younger women, offers much psychologic and sexual objections, it is not an operation to be undertaken too lightly. Koehlin's²² procedure of mastectomy might warrant

TABLE III
Frequency with Which Mass Is Associated with Discharge

	Benign Lesions (47 cases)	Malignant Lesions (25 cases)
Mass Present	38 (81%)	24 (96%)
No Mass Present	9 (19%)	1 (4%)
		Intraductal papillary carcinoma

TABLE IV
Methods of Establishing Diagnosis in 72 Cases

<i>Benign lesions (47)</i>	
Quadrant resection:	43 (palpable tumor and/or positive rotating compression test)
Simple mastectomy:	4 (3 intraductal papillomas, 1 chronic cystic mastitis)
<i>Malignant lesions (25)</i>	
Aspiration biopsy:	14
Excisional biopsy:	5
Nodal biopsy:	2
Quadrant resection:	3
Simple mastectomy:	1

more consideration since it does preserve some semblance of a breast. But it seems to be the most generally held opinion that in these cases of bleeding from unlocalizable areas, if the patients can be carefully followed, signs indicating cancerous changes will become evident by the development of a tumor or by transillumination in ample time for definitive surgery. At first glance, the findings of Geschickter¹¹ (that in 57 cases treated conservatively by Bloodgood, 5 or 9 per cent subsequently developed carcinoma) might seem to make this observation period hazardous. But as Geschickter further reports, in 4 of the 5 there was, even at the time of original examinations, evidence that should have warranted surgery. Two had shadows on transillumination and 2 had scars of old lactation mastitis (a precancerous lesion). So it would appear that if all evidence is carefully evaluated, those cases with nonlocalizable discharge, and no tumor, nodularity or shadows may be watched if one will constantly check for evidence of significant changes. In older women in which the loss of a breast is not too objectionable, one should not be too hesitant to do a simple mastectomy if the bleeding is persistent.

SUMMARY AND CONCLUSIONS

1. Nipple discharges may be either physiologic or pathologic.
2. Pathologic discharges arise primarily from (a) infection, (b) duct stasis or endocrine imbalance, (c) benign growths, and (d) cancer.
3. Types of discharges are not typical of any lesion, though serous or serosanguineous discharges are more frequent in duct papillomas and malignancies. Since any type of discharge may be associated with cancer, all must be investigated.
4. In addition to the character of the discharge, helpful information may be obtained by: (a) examination for a tumor, especially in the subareolar area, (b) transillumination, and (c) localizing area involved by the rotating compression test.
5. If a tumor is found, a shadow seen on transillumination, or the area of origin of discharge localized, the involved area should be removed for diagnosis and treatment.
6. If there is a bloody discharge of diffuse origin, it is more likely to be due to duct papillomas. Since this may be a precarcinomatous lesion, in older women a simple mastectomy should be seriously considered. All cases of this type should be carefully checked periodically, and a more definite diagnostic procedure carried out if any unfavorable change is noted.

REFERENCES

1. Adair, F. E.: Sanguineous discharge from nipple and its significance in relation to cancer of breast, *Ann. Surg.* 91:197 (Feb.) 1930.
2. Bartlett, E. I.: Papilloma of breast, *West. J. Surg.* 56:12 (Jan.) 1948.
3. Bloodgood, J. G.: Benign lesions of female breast for which operation is not indicated, *J.A.M.A.* 78:859 (March 25) 1922.
4. Campbell, O. J.: Bleeding nipple, *Surgery* 19:40 (Jan.) 1946.
5. Cutler, M.: Transillumination as aid in diagnosis of breast lesions, *Surg., Gynec. & Obst.* 48:721 (June) 1929.
6. Cutler, M.: Relation of chronic mastitis, cysts and papillomas to cancer of breast, *J.A.M.A.* 99:2152 (Dec. 24) 1932.
7. Cutler, M.: Problem of bleeding nipple, *J. Internat. Coll. Surgeons* 15:472 (April) 1951.
8. Donnelly, B. A.: Nipple discharge: its clinical and pathologic significance, *Ann. Surg.* 131:342 (March) 1950.
9. Fitts, W. T.: Maxwell, J. D., and Horn, R. C.: Significance of nipple discharge, *Ann. Surg.* 134:29 (July) 1951.
10. Garland, J. H.: Discharge from nipple, *Am. J. Surg.* 82:209 (Aug.) 1951.
11. Geschickter, C. F.: *Diseases of the Breast*, ed. 2, Philadelphia, J. B. Lippincott Company, 1945.
12. Good, L. P.: Significance of discharge from nonlactating breast, *Tri-State M. J.* 15:2932 (April) 1943.
13. Gray, H. K., and Wood, G. A.: Significance of mammary discharge in cases of papilloma of breast; clinical and pathologic study, *Arch. Surg.* 42:203 (Feb.) 1941.
14. Haagensen, C. D., and Stout, A. P.: Carcinoma of breast, *Ann. Surg.* 118:1032 (Dec.) 1943.
15. Haagensen, C. D.: Mammary-duct ectasia, *Cancer* 4:749 (July) 1951.
16. Haagensen, C. D., and others, Papillary neoplasm of breast, *Ann. Surg.* 133:18 (Jan.) 1951.
17. Harrington, S. W.: Carcinoma of breast, *Ann. Surg.* 106:690 (Oct.) 1937.
18. Hicken, N. F.: Mammography; roentgenographic diagnosis of breast tumors by means of contrast media, *Surg., Gynec. & Obst.* 64:493 (March) 1937.
19. Hicken, N. F.; Best, R. R.; Hunt, H. B., and Harris, T. T.: Roentgen visualization and diagnosis of breast lesion by means of contrast media, *Am. J. Roentgenol.* 39:321 (March) 1938.
20. Hinchey, P. R.: Nipple discharge: clinicopathologic study, *Ann. Surg.* 113:341 (March) 1941.
21. Kilgore, A. R.: Risk of cancer in cystic disease of breast, *West. J. Surg.* 43:243 (May) 1935.
22. Koechlin, H.: Bleeding nipple and operation for pendulous breast, *Plast. & Reconstruct. Surg.* 6:387 (Nov.) 1950.
23. Lewis, D.: Bleeding nipples, *Surg., Gynec. & Obst.* 22:666 (June) 1916.
24. Lewisohn, E. F., and Chambers, R. G.: Clinical significance of nipple discharge, *J.A.M.A.* 147:295 (Sept. 22) 1951.
25. Macdonald, I.: Bleeding nipple as diagnostic and therapeutic problem, *California Med.* 68:1 (Jan.) 1948.
26. Marshall, S. F., and Marcum, R. W.: Papilloma of lacteal ducts of breast, *S. Clin. North America* 31:869, 1951.
27. Mathews, W. R.: Personal communication to the authors.
28. Nathanson, I. T.: Present concepts of benign breast diseases, *New England J. Med.* 235:516 (Oct. 3) 1946; 548 (Oct. 10) 1946.
29. Stowers, J. E.: Significance of bleeding or discharge from nipple, *Surg., Gynec. & Obst.* 61:537 (Oct.) 1935.
30. Verhaeghe, M., and Gautier, P.: L'écoulement anormal par le mamelon symptôme providentiel, *Rev. Fr. Gyn. Obst.* 46:84, 1951, abstr. in *Internat. Abstr. Surg.* 93:439, 1951.

POSTPARTUM CARE

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THE OBJECTIVE of an obstetrician should be to see that the mother is in as good, or as nearly good as possible, condition after having had a baby as before. Apparently more important problems occur in the prenatal period. Much more work has been done and written on prenatal complications and care than on postpartum developments. For years I have been interested in trying to prevent postpartum complications.

Six hundred and twelve of my private cases that I have been able to follow for six months have been reviewed. All of these were examined at intervals of six weeks, three months and six months. (All patients are urged to come in for at least three examinations, but for various reasons many do not.)

Type of Delivery of 612 Cases Followed for Six Months

Delivery	Number	Per Cent
Forceps	414	67.64
Spontaneous	149	24.36
Section	30	4.9
Breech	19	3.1
Episiotomy	492	
Laceration	16	
Intact perineum	104	

Followed at Least Six Months

Primipara	255
Multipara	357
Two	198
Three	98
Four	36
Five or more	25

Early ambulation has been the practice for several years. The patient is allowed out of bed as soon as she is able, usually the first time she has a desire to void. In explaining the reason for this she is told that the only way she can get proper rest is by lying down and in like manner the only way she can get adequate exercise is by walking around. Sitting is discouraged for three weeks, not because

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it does damage to the episiotomy wound but because we wish to make the patient conscious that she needs exercise. Usually the patient who moves around more has less complaints related to the perineum. After voiding, sterile water is poured over the perineum. No other treatment is used unless the patient complains. If she does, sometimes we use a heat light, sometimes we apply hot wet applications, other times cold applications, and still other times an application that contains a local anesthetic. Most any of these make the patient more comfortable, but I don't believe they affect the healing process.

In this series only one perineum was infected and had to be drained. After drainage was established the wound healed so that there was no relaxation of the perineum. There were two hematomas. One was recognized early. The perineum was opened and bleeding was controlled and the perineum was resutured. The other was not found until 48 hours after delivery. The hematoma had dissected retroperitoneally up to the promontory of the sacrum. The vaginal mucosa was opened, approximately 500 cc. of clotted and liquid blood evacuated, and strips of gel-foam were placed in the cavity. The vagina was packed for 12 hours to compress the retroperitoneal area. Both wounds healed without evidence of infection and without relaxation of the perineum.

When the patient goes home she is advised to keep the perineum clean with soap and water. She is cautioned to remove all the soap from the perineum. No further treatment is recommended.

Occasionally a thrombosed hemorrhoid occurs. The blood clot is evacuated under novocain anesthesia. Enemas are advised in an effort to prevent the passage of hard stools. Usually no other treatment is needed.

Many patients want to know what type of laxative they should use. If they are nursing the baby they are told that any laxative except oil or bulk laxatives will be excreted in the milk. They are advised to use enemas of normal saline, if needed, to assure a bowel movement at least every other day.

Many patients will complain that they still have a bulging of the anterior abdominal wall. Others will ask "Shall I wear a girdle?" Still others won't mention their abdomen, but they all get the same advice. We attempt to make them posture conscious. The abdominal muscles have been stretched, and they must have exercise for the muscles to regain their tone.

Most of the tone can be restored within six weeks. If, however, protrusion of the abdomen persists, much improvement can be ex-

pected if exercise is practiced. They are told that, to be posture conscious, they must continually keep in mind that the buttocks should be tucked in, the lower abdominal muscles should be pulled in and up, and that the costal margin should be elevated, thus trying to stand as tall as possible. Having them stand in profile in front of the mirror is the best method of showing them how to roll their pelvis which flattens out the lumbar curve and obliterates abdominal prominence.

The value of the knee-chest position has been questioned by many. I advise it. The patient is told that she must get air into the vagina and that the air will force the uterus over in front. This exercise is started about two weeks after delivery when the uterus has become small enough to be a pelvic organ.

In the early thirties I did home deliveries and those patients who did not have modern sanitary conveniences and therefore took no douches had much better appearing cervixes than those who started taking douches at three or four weeks. As the result of this observation I have discontinued the use of douches, at least until they come in for their six weeks examination. When a woman has discharge and the cervix has not healed normally this may be because there have been lacerations of the cervix with improper approximations of the edges. It may be due to infection. I believe not infrequently it may be due to poor drainage caused by a retroverted uterus. In this series of cases 43 cervixes were cauterized at the six weeks examination, 57 at three months examination and 30 at six months examination. Sixteen cervixes were cauterized the second time.

When the patient goes home from the hospital she is told to be as much of an invalid as she can for three weeks. Exercise is gradually increased for six weeks, at the end of which time she should be normal.

At the six weeks examination, if she has any complaints at all they are usually weakness and tired out feeling and backache or both. If she complains of weakness, or a tired out feeling a blood count is done, to see if she has anemia, then her habits are investigated to see if she has been taking an afternoon rest. If she complains of backache she is reminded that 80 per cent of backaches are due to faulty posture and she is encouraged to keep up her exercises. In doing a pelvic examination the presence and degree of bulging of the anterior and the posterior vaginal wall are determined by asking her to strain down like she was going to push a baby out.

A speculum is then inserted and the condition of the cervix is recorded. If there is considerable erosion a cauterization is done, and

	<i>Cystocele</i>	<i>Relaxed Perineum</i>
Slight	76	29
Moderate	50	17
Marked	5	4

Then a bimanual examination is done to determine the position of the uterus, and to rule out any adnexal pathologic change.

Six Weeks Examination

	<i>Uterus</i>
Anterior	401
Posterior	211
Pessary inserted at six weeks.	

Three Months Examination

	<i>Uterus</i>
Anterior	211
Pessary removed at 3 months	

Six Months Examination

	<i>Uterus</i>
Anterior	117 or 56%
Posterior	94 or 44%

the patient is advised to take an acid douche twice daily for one week, then once daily for two weeks and no more until she returns six weeks later. If a retroverted uterus is found, a pessary of the proper size, and usually collapsible in type, is inserted and the patient is shown how to assume the knee-chest position. She is advised to assume this position for two minutes twice a day and return in one week to determine if the uterus is anterior and to make sure that the pessary is causing no irritation by pressure as occasionally happens.

At the three months' visit the same careful examination is made and if she is wearing a pessary it is removed. The six months' examination is no different, and any complaints are investigated.

INGUINAL HERNIA IN INFANCY AND EARLY CHILDHOOD

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THERE appears to be considerable confusion over the proper management of inguinal hernia in infancy and early childhood. Many papers have been published in surgical literature on inguinal hernias; however, only a few of them pertain to the management of those in the early age group. The papers that have appeared on the management of those patients have been controversial.^{3,5,6,8,10,11}

The subject of inguinal hernia in early life is predominantly concerned with the indirect type. Direct hernia in this age group is so rare that it will not be considered.

The cause of indirect inguinal hernia in early childhood is not a muscular weakness but is the failure of the processus vaginalis to obliterate itself. In embryonic life the testis develops high on the posterior wall of the abdomen. Descent of the testis through the inguinal canal into the scrotum occurs behind the advancing invaginated peritoneum (processus vaginalis). This descent occurs during the last trimester of pregnancy. On entering the scrotum the testis and cord become enfolded by the processus vaginalis. This enfolding is never complete. The testis and cord are never completely surrounded by the processus. After complete descent of the testicle the processus vaginalis usually becomes pinched off and forms the ensheathing tunica vaginalis. The upper part of the processus vaginalis normally atrophies; failure to do so results in a congenital indirect inguinal hernia. The preformed sac remains patent at birth in 50 per cent of the infants.² The right testicle descends at a later date than does the left and probably accounts for the higher incidence of indirect inguinal hernia on the right side.

DIAGNOSIS

A hernia may be discovered at birth, or shortly thereafter. A recurrent reducible mass in the inguinal area may be the only evidence of any existing hernia. Failure to demonstrate a hernia even on repeated examination does not exclude its existence. A bulge is usually noticed when the infant is crying or straining. The majority of congenital hernias are usually seen for the first time during the second and third months of life.⁷ The bulge may be small and appear

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at the internal ring, or not infrequently may descend into the scrotum. In small infants the hernial sac usually contains small bowel. The omentum is so poorly developed in infancy that it is rarely found in the sac. The hernia may be asymptomatic, but in many instances the infant is fretful, anorexic, and does not gain weight normally. Incarceration of the hernia is manifested by a persistent swelling, vomiting, and abdominal cramps. Incarceration occurs most commonly during the first six months of life.

It is useless to invert the scrotum in attempting to palpate the hernial sac. Light palpation over the inguinal canal will frequently reveal some thickening if a hernial sac is present. As pointed out by Coles in 1945 and Potts in 1950, a hernia is practically always present when a hydrocele is found in children. If the hydrocele is compressible, a congenital inguinal hernia is always present; likewise when the hydrocele is not compressible, a hernia is present in most instances.

MANAGEMENT

Parents frequently inquire regarding the possibility of a spontaneous cure without therapy. Occasionally the processus vaginalis will become obliterated after birth or during the first few months of life with a spontaneous cure, but this is a rare exception. Ladd and Gross⁷ believe that if a hernia is found after six months of age, almost no hope for a natural cure can be anticipated.

No attempt should be made to cure a hernia by means of the truss alone. Trusses are useful only as a temporary expedient in those patients unable to withstand a general anesthetic. In these patients we have found the yarn truss to be the least objectionable. Larsen⁸ believes that all trusses should be discarded. Potts¹⁰ would limit the use of trusses as a temporary measure only for the weak and sickly child. If the truss is used as a temporary measure, it must be worn 24 hours a day. Not infrequently, the hernia will reappear during the process of crying and when the truss has been removed while the infant is being bathed. Gross⁸ states that he and his associates have practically discarded trusses and have turned to immediate surgery.

If a definite diagnosis of hernia has been made, surgery should be carried out regardless of age, provided the child is healthy and gaining weight. We know of no elective operative procedure which is so gratifying to both the surgeon and the parents as the repair of congenital hernia in infancy and early childhood. Potts¹⁰ reports one questionable recurrence and one death in a series of 600 cases; this death occurred in a premature infant with a strangulated hernia.

The high incidence of incarceration in the early months of life more than outweighs the hazards of operative intervention.¹² Anemia and upper respiratory infections are the most common causes for temporary postponement of surgery.

Ravitch¹¹ would limit the repair of inguinal hernia to infants 1 year of age or older except for the following indications:

1. Incarceration or a history of incarceration.
2. Large size of the hernia.
3. Rapid increase in the size of the hernia.
4. Distress caused by the hernia either to patient or mother.

There is little difficulty encountered in repairing hernias in infancy. With adequate preoperative care, meticulous and gentle surgery, infants withstand surgery as well as adults. No attempt should be made to perform surgery on an infant without the aid of a competent anesthetist. In infants drop ether without preoperative medication is the anesthetic of choice. The structures are smaller and great care must be exercised to prevent injury to vital structures in this region. A reasonable attempt should be made to reduce an incarcerated hernia because of the associated tissue edema, and friability of the sac. The infant should be narcotized and the foot of the crib elevated. An ice pack is applied to the area of swelling. The additional use of a pacifier, reenforced with sugar, will aid materially in obtaining relaxation. If the incarceration can be reduced, surgery is postponed for approximately three days. Frequently the incarceration will reduce itself spontaneously within one to two hours. If after this time gentle pressure fails to reduce the mass, immediate surgery should be carried out.

OPERATION

There is considerable controversy regarding the type of operative procedure to be carried out. In the early part of this century Scottish and English surgeons, notably MacLennan⁹ and Turner,¹³ advised ligation and excision of the sac without any attempt at plastic repair. This procedure is generally known as the Mitchell-Bankes operation. Recently numerous papers advocating the Mitchell-Bankes method have appeared in American literature.^{3,6,10} In this country the modified Ferguson operation has been most generally accepted as the procedure of choice.^{1,4,5,11} The Bassini and Halsted types of operations are still practiced by some surgeons; these require transplanting the cord, which is not necessary in infants and children, and only adds to the magnitude of the operation. Compli-

cations such as hematoma and testicular atrophy are more common when the cord is transplanted.

The end results are good in the operative repair of congenital hernias with either the Mitchell-Bankes or Ferguson operation. Certainly any attempt to transplant the cord should be condemned. The Mitchell-Bankes procedure in infants under 1 year of age, and a modified Ferguson procedure in those over 1 year of age, appears to be the best methods of treatment in the usual type of congenital hernia. The occasional infant with a large opening at the internal ring will require some additional plastic repair. If bilateral hernias exist in infants and young children, there is no valid reason why both cannot be repaired at one operation.

STATISTICS

We have reviewed the records of 200 patients with indirect inguinal hernias from birth to 6 years of age. All of these patients were operated upon in the hospitals of Charleston, West Virginia by various surgeons. It is significant that 25 per cent of this group were infants under 1 year of age. Ninety per cent of the incarcerations were present during the first year of life.

Ninety-four and one-half per cent were found in males and bilateral hernias were found in only $4\frac{1}{2}$ per cent of the group. This incidence of bilateral hernias is much lower than that reported by most authors.^{7,10}

An associated hydrocele was present in 15 per cent of the patients. Nineteen per cent had incarceration present at surgery and 41 per cent gave a history of recurrent incarceration.

The types of operations performed were: Modified Ferguson $74\frac{1}{2}$ per cent, Mitchell-Bankes $13\frac{1}{2}$ per cent, Bassini 10 per cent, and Halsted 2 per cent.

We were able to obtain follow-up observation in 86 per cent of these patients, ranging in time from six months to five years. One recurrence was reported in a premature baby that had a modified Ferguson repair for an incarcerated right indirect inguinal hernia. In this patient all tissues were poor, and the peritoneal sac was unusually thin. It was questionable if the sac had been ligated and excised satisfactorily. Another patient had a wound separation following a midline exploration for intestinal obstruction. The obstruction was found to be from a right inguinal hernia and the sac was ligated and excised from above; although this patient had a rather stormy course, and the diagnosis was missed originally, it is interesting to note that the hernia has not recurred after two and one-

half years. The vas deferens was accidentally divided in 1 case, and the ilioinguinal nerve was severed in another. In only 1 patient was a bowel resection necessary; this patient was 7 months old, and made an uneventful recovery. No deaths occurred in this group of 200 patients.

SUMMARY

After reviewing the literature and studying reports previously mentioned, we believe that the following points hold true in the management of inguinal hernia in infants and children:

1. Infants and children tolerate surgery well.
2. Trusses are of little value in these hernias. A poor truss, or an ill fitting good one, may actually do harm.
3. The incidence of incarceration is much higher during the first year of life.
4. The Mitchell-Bankes operation should be employed in infants up to 1 year of age, certainly never more than a modified Ferguson repair. The Ferguson technic is recommended for children 1 year of age and older.
5. Bilateral hernias should be repaired at one operation.
6. The Bassini or Halsted operation should not be used in infants and children.
7. Hernias should be repaired early in life to prevent complications. The occasional recurrence is probably the result of a technical error.

REFERENCES

1. Bigger, I. A.: Personal communication to the author
2. Callander, A. B.: *Surgical Anatomy*, Philadelphia, W. B. Saunders Co., 1948, p. 296.
3. Coles, J. S.: Operative cure of inguinal hernia in infancy and childhood, *Am. J. Surg.* 69:366 (Sept.) 1945.
4. Daniel, D. S.: Personal communication to the author.
5. Gross, R. E.: Personal communication to the author.
6. Herzfeld, G.: Hernia in infancy, *Am. J. Surg.* 39:422 (Feb.) 1938.
7. Ladd, W. E., and Gross, R. E.: *Abdominal Surgery of Infancy and Childhood*, Philadelphia, W. B. Saunders Co., 1941.
8. Larsen, R. M.: Inguinal hernia in infancy and early childhood, *Surgery* 25:307 (Feb.) 1949.
9. MacLennan, A.: Radical cure of inguinal hernia in children, *Brit. J. Surg.* 9:445, 1922.
10. Potts, W. J., Riker, W. L., and Lewis, J. E.: Treatment of inguinal hernia in infants and children, *Ann. Surg.* 132:566 (Sept.) 1950.
11. Ravitch, M. M.: Personal communication to the author.
12. Thorndike, A., and Ferguson, C. F.: Incarcerated inguinal hernia in infancy and childhood, *Am. J. Surg.* 39:429 (Feb.) 1938.
13. Turner, P.: Radical cure of inguinal hernia in children, *Proc. Roy. Soc. Med.* 5:133, 1912.

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CARCINOMA OF THE RECTOSIGMOID AND UPPER PART OF THE RECTUM; INDICATIONS FOR ANTE- RIOR RESECTION AND ANASTOMOSIS

Anterior resection with re-establishment of continuity of the bowel by means of end to end anastomosis would seem to be indicated in cases of carcinoma of the lower part of the sigmoid and, less often, in cases of carcinoma of the upper part of the rectum, when at least 2 cm. of normal sigmoid or normal rectum distal to the lower border of the tumor can be removed.

A question often asked is: How far down in the lower part of the sigmoid or how high in the upper part of the rectum can a growth be and still be susceptible of anterior resection? This question is difficult to answer. Relatively few lesions in the upper part of the rectum can be satisfactorily resected by this method. For the most part, the operation under consideration is intended for lesions at or near the pelvic peritoneal reflection. Even though measurements are not made in the same way by all proctologists, if a lesion is said by a proctologist to be 10 cm. from the anal margin, in most

instances there is good reason to hope that anterior resection, with re-establishment of continuity of the bowel can be carried out. It is well, however, to mention here that carcinoma at or immediately proximal to the peritoneal reflection, if a patient is short and obese, may not lend itself to anterior resection followed by anastomosis, whereas a similar lesion in approximately the same segment of bowel, if a patient is slender, may be adequately removed by anterior resection. Many factors, then, make such a type of resection possible or impossible.

Anterior resection with an anastomosis is well carried out according to the following technic: Abdominal incision is made through the left rectus muscle, the lower end of the incision beginning at the pubis. The lower part of the descending colon, or the first portion of the sigmoid is divided. The superior hemorrhoidal vessels always are sacrificed; not to do this seems insufficiently radical. The adjacent mesentery and mesosigmoid also are sacrificed. Clean, radical resection requires a liberal cuff of posterior parietal peritoneum medial and lateral to the bowel. The bowel then can be well mobilized by placing the right hand in the hollow of the sacrum; this permits the bowel that is below the point of division to be pulled upward. Rubber-covered, curved clamps are then applied to the lower part of the sigmoid or upper part of the rectum. The segment of bowel above the clamps is then removed and end to end, open anastomosis is established.

Many surgeons establish a proximal, temporary colonic stoma in the transverse colon in every case in which they perform low anterior resection with anastomosis. They close the stoma some weeks after the site of anastomosis has become well healed. The rationale of this procedure is that some low anastomoses leak. For instance, studies have been made of patients on whom anterior resection had been performed and concurrently a temporary double-barrelled colonic stoma had been established. From a few weeks to two or three months afterward, a thin suspension of barium was injected into the distal segment of colon, through the lower, or distal, stoma. In other cases similar suspensions were injected through the rectum. In roentgenograms of 25 per cent of patients who received the injections, shadows of finger-like projections of barium could be seen extending outward from the site of anastomosis. Yet many other surgeons consider a temporary stoma unnecessary. In the majority of cases there is no evidence of leakage, of course, and even if leakage does occur and a fistula forms, it may heal spontaneously. Whether or not to employ a temporary stoma is a matter that

should be left to the individual surgeon to decide. I establish a temporary colonic stoma in all such cases.

Low anterior resection and anastomosis often is done as a palliative procedure. Even though there are one or two nodules in the liver and involved nodes in the mesentery, to carry out this operation is justifiable if the patient is otherwise in good health.

In a group of several hundred cases some operations will be performed for palliation and some for cure. Taken all together, if a surgeon performs anterior resection and anastomosis in properly selected cases over a period of 20 years, the survival rate at the end of 5 to 10 years after operation probably will compare favorably with that following other operations in which establishment of a permanent colonic stoma is considered necessary.

Preoperative preparation well can include administration of 3,000 mg. daily of terramycin for 3 to 3½ days. Such administration greatly lessens peritonitis and wound infection; it seems, furthermore, not to entail undesirable consequences. Nevertheless, this and many others of the so-called miracle preparations should be given judiciously and not for long periods. Some untoward effects of use of chemotherapeutic agents are being encountered. It might be well to keep in mind that certain powerful agents against disease have the potentiality of killing more than bacteria. Yet the agent itself may be relatively innocent; the fault may lie in its continued or prolonged use. In the morning of what has been hailed, very likely with reason, as a triumphant era in medicine and surgery, the physician will not forget the precept: "First of all, do no harm."

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BOOK REVIEWS

The Editors of THE AMERICAN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.

SURGICAL TECHNIQUE. By STEPHEN POWER, M.S., F.R.C.S., Service Surgeon Dreadnought Hospital, Greenwich; Surgeon Royal London Homoeopathic Hospital and the Eltham Hospital. Cloth Binding. 380 pages. Illustrated. J. B. Lippincott Company, East Washington Square, Philadelphia, Pa. 1952. \$6.50.

This volume is a well written informative introduction to various surgical technics used by the author in his practice in the British Isles. There are many interesting and new modifications of technic which we do not see in our American hospitals but which I am sure are sound and worthwhile.

There is no mention of the skin detergents and hexachlorophene nor are any other antibiotics other than penicillin discussed. In general, there seems to be a greater tendency to drain wounds than we are accustomed.

The booklet seems to over-emphasize the traumatic surgical side which is well and good, but more of our practices find the traumatic cases to be by far in the minority.

The paper is excellent quality and the print is easily legible and the illustrations are clear. The binding is in the usual good quality that is found in Lippincott's books. The author's style is typically British in that they have a forthright manner of saying things that make their works easily readable and understood.

This is one of the better British books we have encountered in the barrage of books beamed to us since the close of the war. It will be interestingly accepted by our surgeons.

A. H. LETTON, M.D.

POST-GRADUATE LECTURES ON ORTHOPEDIC DIAGNOSIS AND INDICATIONS.
Vol. III. By ARTHUR STEINDLER, M.D., F.A.C.S., Professor of Orthopedic Surgery, State University of Iowa. Springfield, Illinois, Charles C Thomas, 1952. 284 pages, \$8.75.

This is the third and last in the series of lectures by Dr. Steindler and this text, like the preceding, contains much worthwhile and valuable material. The book is divided into two sections: Section A concerns tuberculosis of the skeletal system and Section B concerns osteomyelitis.

Lecture I under Section A is concerned with orientation, pathogenesis and pathology and is a good review of these subjects.

In the second Lecture the author presents an extremely clear and comprehensive discussion of Pott's Disease. The various types of vertebral involvement as well as clinical signs, diagnosis, and treatment of tuberculosis is discussed.

The third Lecture deals with tuberculosis of the hip joint and the fourth with tuberculosis of the knee. Both are illustrated nicely and contain a good discussion of treatment.

The fifth and sixth Chapters in this Section are extremely well presented and give an enlightening discussion of acid-fast involvement of the ankle, foot, and upper extremity.

Section B is also divided into six Lectures. The first is concerned with orientation and pathology; whereas in the second Lecture, acute and chronic osteomyelitis is differentiated. The value and use of blood transfusion, serum, various antibiotics and the operative treatment is discussed individually in the next chapter. The final two chapters are devoted to osteomyelitis of the pelvic bones and the more unusual types of osteomyelitis including that due to typhoid, Malta fever, salmonella, smallpox, mycotic and echinococcus infections.

The author has selected many fine illustrations and the reproductions of the radiographs are good. A complete bibliography is always an asset and Dr. Steindler is again to be congratulated upon writing a book that will be of interest and help to all readers.

WOOD W. LOVELL, M.D.

CULDOSCOPY—A New Technique in Gynecologic and Obstetric Diagnosis.

By ALBERT DECKER with foreword by RICHARD W. TELINDE. Philadelphia and London. W. B. Saunders Company, 148 pages, 1952. \$3.50.

Although culdoscopy has been used as a diagnostic procedure in some clinics for the past eight or ten years, its acceptance has not been widespread. This excellent monogram presents the subject in a comprehensive manner and will greatly enhance its adoption and, it is hoped, aid in reducing the too often used diagnostic laparotomy.

The anatomy of the vagina is reviewed. The culdoscope is described and instructions for the care of the instrument are given. The technic for culdoscopic examination is very vividly presented.

The use of this diagnostic procedure in various gynecologic and obstetric conditions is discussed and the pathological conditions which may be seen by culdoscopic examination are described. Several interesting cases from the author's experience are presented.

Throughout the edition the illustrations, both photographic and drawn, are excellent.

This monogram will be very useful to the gynecologist and should be made available to all those who are receiving their obstetrical and gynecological training.

JOSEPH M. ECHOLS, M.D.

RARE MANIFESTATIONS OF METABOLIC BONE DISEASE. By I. SNAPPER, M.D., Ph.D., Director of Medical Education, Mt. Sian Hospital; Clinical Professor of Medicine, Columbia University College, Physicians and Surgeons of New York City. 96 pages with illustrations. Springfield, Illinois. Charles C Thomas, Publisher. \$3.00.

The author has brought into this little volume a rather scholarly collection of pertinent data on some of the metabolic bone diseases. He not only relates the usual signs and symptoms of these diseases, but also incorporates some of the rare manifestations of these diseases and presents them in the form of case reports.

This volume is No. 107 in the American Lecture Series and was delivered at the 29th Annual Beaumont lecture before the Wayne County Medical Association of Detroit in February, 1950. The binding and printing is identical with the rest of this series. This book is certainly of interest to the pathologist and orthopedist as well as to the internist and surgeon and should be included in all complete libraries.

A. H. LETTON, M.D.

Books received are acknowledged in this section, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE TREATMENT OF INJURIES TO THE NERVOUS SYSTEM. By DONALD MUNRO, M.D., F.A.C.S., Surgeon-in-chief, Department of Neurosurgery, The Boston City Hospital; Associate Professor of Neurosurgery, Boston University School of Medicine, 284 pages with 47 figures. Philadelphia and London, W. B. Saunders Company, 1952. \$7.50.

METABOLIC BONE DISEASE. By I. SNAPPER, M.D., Ph.D., Physician and Director of Medical Education Mt. Sinai Hospital, Clinical Professor of Medicine Columbia University College of Physicians and Surgeons, New York City. Springfield, Charles C Thomas, 1952. \$3.00.

BATTLE CASUALTIES. By GILBERT W. BEEBE, Ph.D., Division of Medical Sciences National Research Council, Formerly Captain, Medical Administrative Corps, A. U. S. and MICHAEL E. DE BAKEY, Professor of Surgery, Baylor University College of Medicine, Formerly Colonel, Medical Corps, A. U. S. Springfield, Charles C Thomas, 1952.

TEXTBOOK OF GENERAL SURGERY. By W. H. COLE, M.D., F.A.C.S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Chief Surgeon, Illinois Research and Educational Hospitals, Chicago, and Robert Elman, M.D., F.A.C.S., Professor of Clinical Surgery, Washington University School of Medicine; Assistant Surgeon, Barnes Hospital; Associate Surgeon, St. Louis Children's Hospital; Chief of Staff and Director of Surgical Service, H. G. Philips Hospital, St. Louis. Foreword by E. A. Graham, M.D., F.A.C.S. Sixth Edition, New York, Appleton-Century-Crofts, Inc.

PHARMACOLOGY IN CLINICAL PRACTICE. By HARRY BECKMAN, M.D., Director, Departments of Pharmacology, Marquette University Schools of Medicine and Dentistry; and Consulting Physician, Milwaukee County General Hospital and Columbia Hospital, Milwaukee, Wisconsin. Philadelphia and London, W. B. Saunders Company, 1952. \$12.50.

ABSTRACTS FROM CURRENT LITERATURE

POSTCHOLECYSTECTOMY SYNDROME TREATED BY VAGOTOMY. E. P. Coleman and D. A. Bennett. *Journal of the International College of Surgeons* 17, 865-871 (July) 1952.

The authors have personally observed 68 cases in which symptoms have persisted after cholecystectomy. Fifty-four of these were from their personal series of 487 cholecystectomies, 12.7 per cent, and 14 had been operated upon elsewhere. In this group the following conditions were noted:

"1. There were 24 patients with relatively mild symptoms, which, however, caused the patients to complain and to feel that the results were not completely satisfactory. With few exceptions these occurred in obese persons who were fond of eating and to whom any dietary restriction was a definite hardship. . . .

"2. There were 12 cases in which operation was necessary for common duct stones, 4 of them on two occasions each. . . .

"3. In 5 cases there was a large gallbladder remnant, 3 of them containing a stone. Removal of these five remnants produced complete relief of symptoms.

"4. There were 3 cases in which the patient had been told that the gallbladder had been entirely removed. . . . yet . . . the gallbladders were found to be present and intact, 2 of them empyematous and 1 containing many stones.

"5. Four patients were found to have pancreatitis, with a sufficient amount of thickening of the head of the pancreas to produce biliary symptoms.

"6. There were 2 patients who were subsequently found to have diaphragmatic hernias.

"7. In 6 cases there were additional pathologic conditions overlooked at the time of the original operation. In 3 of these there were stones in the right kidney; in 1, a duodenal diverticulum, and in 2, definite pelvic disease which had probably been the sole cause of symptoms.

"8. In 6 cases . . . , the final outcome revealed abdominal malignant disease not discovered, or possibly not present at the time of the original operation. . . .

"9. There was 1 case of food allergy. . . .

"10. In the 5 remaining cases in this series, the patients were treated by vagotomy. . . ."

Of the 5 cases treated by vagotomy, 3 had practically identical symptoms. All 3 had had cholecystectomy elsewhere and had persistent colicky pain. After investigation, the authors believed that the gallbladders were all removed as a result of inadequate study and probably with very little pathologic change present in the gallbladder. Each one, on roentgenologic examination, had a duodenal deformity. Surgical intervention was undertaken for treatment of the supposed duodenal ulcer and vagotomy was done prior to exploration which revealed the deformity of the duodenum in each case to be due to adhesions secondary to the previous cholecystectomy. All 3 of these patients have subsequently been asymptomatic.

The fourth patient in this group was reoperated upon because of persistence of symptoms and the common duct explored without significant findings. The symptoms were relieved as long as the T tube stayed in place but recurred as

soon as it was removed. Subsequent vagotomy relieved the symptoms and the patient has remained symptom free for a period of over three years.

The fifth patient had had common duct stones removed at the original operation and the common duct drained. Symptoms recurred after removal of the T tube. Reexploration of the duct was negative and vagotomy was performed. The patient has been well for over two years at the time of this report.

The authors are convinced that "in cases of the true postcholecystectomy syndrome due to biliary dyskinesia, vagotomy may be necessary to relieve the patient."

R. H. S.

THE ACCURACY OF THE DIAGNOSIS OF ENDOMETRIOSIS. A Review of One Hundred and Three Cases. T. A. Sinclair. *American Journal of Obstetrics and Gynecology* 63, 1334-1337 (June) 1952.

The incidence of histologically proved cases of endometriosis in various series varies from 1.8 per cent to 28 per cent. Sinclair finds it difficult to imagine that the inherent differences in clientele would account for such great variations in the incidence of this disease. Knowing noted marked differences between the operative and the histologic diagnosis of endometriosis in his recent cases, he believes that it is likely that these differences in reported incidence are due to errors or to difficulties of accurate diagnosis.

In 1,944 major operations on the Gynecologic Service at Hermann Hospital from January 1948 to July 1950, a diagnosis of endometriosis was made in 103, or 5.3 per cent. In 31 per cent of these, the diagnosis was surgical only; in 17.4 per cent, it was made only after histologic examination and in the remaining 51.4 per cent, the diagnosis was made by both methods. Thus, of 85 cases diagnosed as endometriosis at surgery, only 53, or 62 per cent, were confirmed histologically. The author reviews the difficulties of histologic diagnosis of this disease and his contention that this error can be reduced by more concentrated effort is substantiated by the experience of two surgeons on the staff of the Hermann hospital who, taking a special interest in endometriosis, have made the diagnosis at the operating table in 16 instances, all of which were confirmed histologically.

R. H. S.

PERSISTENCE OF SYMPTOMS FOLLOWING CHOLECYSTECTOMY WITH SPECIAL REFERENCE TO ANOMALIES OF THE AMPULLA OF VATER. Warren H. Cole and William J. Grove. *Annals of Surgery* 136 (July) 1952.

Herein, the authors emphasize anomalies of the Ampulla of Vater and duodenal papilla as a cause of persistent symptoms following cholecystectomy and urge that, when exploratory celiotomy fails to reveal other cause, opening of the duodenum and inspection of the ampulla be carried out. In addition to such anomalies, persistence of symptoms may be due to stone in the common duct, chronic pancreatitis, enlarged cystic duct stump, and, in the case of error in diagnosis, lesions outside the biliary system.

Two cases illustrative of persistence of symptoms after cholecystectomy, in which symptoms were relieved by correction of anomalies of this region, are reported. In 1 case an unusually small lumen of the ampullary opening was treated by sphincterotomy. In the other case, a bridge between the pancreatic duct and the common bile ducts which rendered the opening of the common

duct only about 1 mm. in diameter, was clipped. This latter patient, who was an inmate of a mental institution, was relieved of right upper quadrant pain but later developed left lower quadrant pain.

Other methods of dealing with this syndrome such as splanchnicectomy, sympathectomy, excision of nerve fibers around the common duct, or transplantation of the common duct into the lumen of the bowel are discussed.

In conclusion, the authors stress that although such anomalies as are considered here do occur, they are relatively rare and persistent symptoms following cholecystectomy will more frequently be found to be due to common duct stone or chronic pancreatitis.

R. H. S.

POSTERIOR TRIANGLE OPERATIONS AND TRAPEZIUS PARALYSIS. Sedgwick Mead. *Archives of Surgery* 64, 752-755 (June) 1952.

The accessory nerve is vulnerable to injury during operations in the posterior cervical triangle. It traverses this space from the posterior edge of the sternomastoid muscle to its entrance into the superior edge of the trapezius. The nerve trunk is small and lies rather superficially beneath the skin. The operator is rarely conscious of injury to this nerve during surgical procedures.

During the year preceding this report, Mead examined 6 patients who suffered injury to the twelfth nerve incident to surgery in the posterior cervical triangle. These cases are briefly reported herein. In a discussion of treatment, it is urged that the nerve be sutured as soon as the diagnosis is made. The author concludes that elective operative procedures should not be carried out through the posterior triangle if there be an alternative.

R. H. S.

ADVANTAGES OF A STAB WOUND ILEOSTOMY. Frank H. Lahey. *Surgery, Gynecology and Obstetrics* 95, 29-32 (July) 1952.

Making no claim to originality, Lahey points out the mechanical advantage, that permanent ileostomy through a stab wound offers, over bringing the ileostomy out through an incision when a cemented-on type of ileostomy bag is to be employed. The deep groove presented by the incisional scar after the patient gains weight makes application of the bag difficult. This is avoided when a stab wound is employed.

As is usual in communications from this clinic, excellent illustrations are included.

R. H. S.

THE MANAGEMENT OF ACUTE CHOLECYSTITIS. Russell L. Mustard and Harry R. Custer. *Surgery, Gynecology and Obstetrics* 95, 59-62 (July) 1952.

In this brief communication, the authors offer their ideas on the problem of early operation in acute cholecystitis versus conservative management followed by interval cholecystectomy. Their conclusions are apparently based on their observations of 211 cases of acute cholecystitis seen in a 10 year period. Of these cases, they were able to send home 172 of these patients without incidence of uncontrolled perforation or mortality. Of the remaining 39, 3 patients died without having been operated upon, 28 underwent cholecystectomy and 8 were subjected to cholecystostomy. Two of the group who were operated upon died. The conclusions are quoted in part:

"The general trend of this treatment has been toward aggressive conservatism with surgery reserved for those patients showing signs of uncontrolled and spreading abdominal disease.

"There was no mortality in the age group below 50 years and 2.3 per cent mortality in the group over the age of 50.

"The dangers of surgery in the presence of acute inflammation with all of its concomitant findings around the delicate anatomy of the biliary ducts, especially in the hands of partially trained surgeons, have been discussed.

"Therefore, we have reached the conclusion that any trend of thought is not sound which leads to the increasing popularity of difficult technical procedures performed in a dangerous area by untrained surgeons."

R. H. S.

MOTOR FUNCTIONS OF THE CAT'S COLON FOLLOWING EXCISION OF AUERBACH'S PLEXUS. Frederick W. Klinge. *Annals of Surgery* 136, 162-166 (July) 1952.

Complete absence of both the Auerbach's and Meissner's plexuses in the rectum and restosigmoid segments of the large bowel characterize Hirschsprung's disease. Segments presenting this agenesis exhibit narrowed lumina and do not participate in the peristaltic movements originating proximally. In cats, the author removed the longitudinal muscle, Auerbach's plexus and the outer one-third of the circular muscle from a segment of the sigmoid colon. Meissner's plexus and the inner layers of circular muscle were left intact. After an interval, the animals were reoperated on and the segment studied in vivo. After sacrifice, the segment was further studied in vitro. Such removal of Auerbach's plexus did not result in intestinal obstruction over a five to six month period.

The author concludes that the circus movement of excitatory impulses in the circular muscle produce tetanic contraction and functional obstruction and feels that this hypothesis explains the permanent success of myotomy in pyloric stenosis and cardiospasm and the early promising results of myotomy in Hirschsprung's disease.

R. H. S.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION
REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMEND-
ED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United
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B. T. BEASLEY, M.D., Managing Editor.

Sworn to and subscribed before me this 17 day of September, 1952.

MRS. J. H. BAUKNIGHT, Notary Public.

(My commission expires Feb. 14, 1956.)

